THE BRICKBVILDER

AN ARCHITECTVRAL MONTHLY

VOLVME XXII — OCTOBER 1913 — NVMBER 10

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PVBLISHED MONTHLY BY

NEW YORK — ROGERS AND MANSON COMPANY — BOSTON

ARTHVR D. ROGERS, PRESIDENT AND TREASURER — RALPH REINHOLD, VICE-PRESIDENT AND BVSINESS MANAGER — RVSSELL F. WHITEHEAD, SECRETARY AND MANAGING EDITOR

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SUBSCRIPTION RATES

For the United States, its insular possessions and Cuba, $5.00 per year

For Canada, $5.50 per year — For Foreign Countries in the Postal Union, $6.00 per year

All copies mailed flat

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CHURCH AT MERBAKA, ARGOLIS, GREECE

Exterior walls of stone and common brick in alternate courses, with inset plaques of polychrome terra cotta. Twelfth century.

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OCTOBER, 1913

VOLVME XXII. NVMBER 10.

An Appeal to the Architect for the Adoption of the Quantity System.

BY SULLIVAN W. JONES.
(Palmer, Hornbostel & Jones, Architects, New York.)

"ARCHITECTURAL temperament" seems to render its possessor immune from the effects of practical criticism of his conduct of the technical and executive ends of his profession. However, such criticism is sometimes necessary and pertinent, and in this case justified by the effort to penetrate the architect's "temperamental" shell of self-assurance and omniscience, for the purpose of directing his attention to the compelling need of radical reform in the present method of securing competitive tenders for building contracts.

Possibly such a statement is not a prudent introduction to an appeal to the architect. But if we seek to produce the spark of interest, we must strike with the cold bare steel of truth, even at the risk of creating a feeling of resentment. The truth is not always agreeable.

None of the observations here set down should be considered as suggesting, or even implying, that any of the architect's material or practical qualifications, desirable though they may be, are of sufficient importance to warrant a sacrifice of that one essential characteristic — the inherent ability to create architecture which gratifies the esthetic sense.

There is little or no evidence that the architect in his individual capacity has devoted any constructive thought to the active relationship existing between himself, the contractor, and the owner. Contracts, drawings, and specifications which continue to emanate from the architect's office would seem to indicate either a blissful unconsciousness or a total disregard on his part of a very critical and unwholesome situation in the field of building activity. It is hard to believe that the architect lacks the courage of his convictions, and yet in the light of discussions before contractors' organizations all over the country, many of which have found their way into the columns of architectural periodicals, it is strange that there is no reflex or reciprocal action on his part. The reform movement should be initiated by the architect — and promptly — otherwise the hitherto passive demand by the better element in the contracting fraternity for a square deal will become aggressive, resulting in a situation reflecting discredit on architectural practice.

The fundamental element in the building contract is the drawings and specifications, since their expressed purpose is to define and limit the amount of work to be performed. The contract, as an instrument, is of secondary importance. The first essential, therefore, of the drawings and specifications is that they should define the work with such clearness and precision that there can be no doubt in the minds of the bidders as to the exact amount and character of the work called for; and, consequently, that all bidders may compute their estimates on precisely the same basis. It is a fact that drawings and specifications issued by the vast majority of architects fail wofully in this essential requirement. The drawings in many cases are obscure, impractical, and lacking in detail; and it is not an exaggeration to say that the specifications are seldom properly explicit. The failure of the drawings and specifications to perform their essential function is due largely to a want of intelligent preliminary investigation, a lack of accurate technical knowledge, and, in specification writing, an absence of practical experience and the power of expression. Specification writing, it must be remembered, however, is a task of great difficulty requiring no little literary acumen. In the production of these important documents, the architect's present-day methods are wholly obsolete and totally inadequate to the tremendous complex contracting operations of to-day, involving as they do large amounts of capital.

The use of blanket clauses in the contract, vesting the architect with arbitrary and sweeping powers, constituting him a court of last resort on all questions arising as to the performance on the part of the contractor, indicates that the architect is conscious of his failure to fully perform his obligations to the owner and the contractor. Such conditions are subversive of all good business principles, and provoke nearly all, if not all, of the evils and mild forms of corrupt and ethically dishonest practices in the contracting business. The combination of deficient drawings and specifications with a stringent contract, placing unlimited discretion in the hands of the maker of those drawings and specifications, results in a situation where the architect holds the solvency of the contractor in his palm. Such a situation is unjust alike to the contractor, the architect, and the owner, and one from which the fair-minded architect seeks escape.

Two very obvious alternative conclusions are adduced from this arraignment of facts: first, that the form of contract generally in use should be modified to afford the bidders protection in bidding upon the basis of a reasonable interpretation of the requirements of the obscure and

deficient drawings and specifications. Or second, that the present form of contract be adhered to generally, and the method of describing the work to be performed be altered so that the basis of the contract — the description of the work covered — shall be precise and shall not be capable of more than one clear and definite interpretation by the bidders. It is recognized, however, that the interpretation of words is an extremely complex and difficult subject in a country so large, where the same word means different things in different parts of the country. There are many good and sufficient reasons for retaining, at least for the present, the stringent contract. But that is a large and engrossing subject, which is not pertinent to this discussion. We therefore turn to a consideration of the second conclusion: that the description of the work to be performed must take the clearer and more precise form.

It is patent to the architect, at least, that under the present system of producing drawings and specifications for estimates, it will be well-nigh impossible to effect any material uplift in the standard. We must therefore work a change in the system of production — a change which will have the desired effect in spite of the indifferent attitude on the part of the average architect.

Let us here pause a moment to examine the conditions obtaining to the computation and submission of competitive estimates under the present system. The architect issues the drawings and specifications illustrating and describing the work to be performed. These drawings and specifications are usually prepared under high pressure, which invariably finds expression in inconsistencies between the drawings and specifications and between the several drawings, ambiguity, and omissions. The drawings and specifications are placed in the estimating departments of the various contractors' offices and bills of quantities are prepared. The quantity taking is carried on with more or less difficulty and uncertainty according to the degree of clearness and precision of the drawings and specifications, and the scope and complexity of the work; and generally also under high pressure, because the time allowed for bidding is far too short. Under such unfavorable conditions the chances for errors in the quantities are enormous. The bills of quantities are prepared and the whole bid is subjected to careful scrutiny, in connection with which consideration is given to the character of the other contractors bidding, the probability of profitable extras resulting from the deficiencies in the drawings and specifications, the chances for success in decreasing the cost through substitutions and evasions, and the stringency of the supervision. The contractor is not to be blamed for adopting such a course. It is, with him, a matter of necessity. He must first secure the work and then exert himself to the utmost to find a profit. The final result is that the contract is awarded to the unfortunate bidder who has made the most serious error. Contractors have fallen into the habit of calling these deplorable conditions "keen competition." They are deceiving themselves. There is no real competition — only reckless gambling on the precision with which quantities can be taken and on the shrewdness of the bidders in surveying their chances for recouping their probable losses in the estimate.

The "cost plus a percentage" contract and a contract based upon a bill of quantities are similar in their fundamentals. In both there is no preliminary gamble on the quantities and character of the materials required for the execution of the work. In both, the contractor's compensation bears a fixed relation to the amount of work performed. And in both, sheer efficiency, not shrewdness, means success. The contract based upon definite quantities, however, eliminates all of the questionable features of the "cost plus a percentage" contract, operating against its general adoption.

The striking contrast between the *esprit de corps* on work executed by a competent contractor on the cost basis, and the spirit of evasion and vindictiveness which pervades the work executed under a lump sum contract, awarded through competitive bidding, lends the weight of conviction to an argument for the establishing of any system of estimating, removing from the situation the factors of doubt, and producing a spirit of co-operation and fair dealing.

Believing that a solution of the problem lies in the establishment of the quantity system of estimating, now generally in vogue throughout Europe, the Association of United States Quantity Surveyors has been organized by a few architects and engineers, and a number of contractors and estimators representing many of the trades. The system proposed, contemplates estimating on bills of quantities, and not on drawings and specifications. The architect in this country has been putting "the cart before the horse." Questions as to the true intent and meaning of the drawings and specifications, and as to the exact quantities of work required under them, now arise after, instead of before, the contract is let. The same questions will arise in the mind of the quantity surveyor, in the preparation of his bills, as now arise in the minds of the bidders. The preparation of the bills of quantities will therefore constitute a check in the interest of the owner, and will, in effect, be a guarantee on the sufficiency of the drawings and specifications. With the inauguration of the quantity system, the skilled estimator will step out of the contractor's office into a field of his own with a recognized professional standing. He will be called in by the architect to prepare bills of quantities, just as the various experts are now called upon to perform their professional functions in connection with the preparation of information for bids.

There is nothing revolutionary about the quantity system of estimating. It has been practised in this country in modified and more or less ineffective forms for a number of years, chiefly by engineers. There is a statute in the state of Pennsylvania requiring the publication of bills of quantities with the drawings and specifications on all public works. The Bridge Department of the city of New York has made a practice of issuing bills of quantities with the drawings and specifications for work under the department's jurisdiction. But in both of these cases the ends sought are completely defeated because no responsibility is assumed for the accuracy of the bills. The bidders, therefore, disregard them and take their own quantities. The system is firmly established in most of the countries of Europe. The English system is probably the best known and most frequently referred to. In 1909, at a conference between the National Federation of Building Trades Employers, the Institute of Builders, and the London Master Builders' Association, all of Great Britain, a

resolution was adopted recommending that the members of these powerful organizations decline to bid in competition with one another unless bills of quantities were supplied for their use at the owners' expense. It would be well if some such concerted action were taken by the many contractors' organizations in this country.

Any American system must be formulated upon the basis of present American practice in estimating, and adapted to the peculiar requirements of American methods. A brief review of the English system will, however, prove illuminating and will plant the red flag over the pitfalls to be avoided in any constructive work done in this country.

The quantity surveyor in England receives a fee based upon a fixed percentage of the cost of the work. The fee is placed at the bottom of the money column in the bill of quantities and is added to the total amount of the estimate. The successful bidder pays the surveyor's fee. If no contract is let, custom has established the right of the quantity surveyor to collect his fee from the owner. In the one case the owner pays the fee indirectly, and in the other, he pays it directly. Is there any logical reason why the fee should not in all cases be paid directly by the owner? The conditions of payment under the English system inject into the situation an element of uncertainty as to who does actually employ the quantity surveyor. The courts have held that the architect employs him with the implied authorization of the owner. Nevertheless, in many cases where the bill of quantities has proved deficient, the contractor has believed that he had the right of recovery against the quantity surveyor since he was paying for his service. The question will immediately arise in the mind of the reader: "Why should there be any dispute as to the sufficiency or deficiency of the bill of quantities?" The answer is: that the bill does not constitute the basis of the contract. Here is the most glaring inconsistency in the English system, precipitating innumerable disputes and litigations. English practice is to compute the estimates solely upon the bill of quantity. The drawings and specifications are not issued to the bidders, but are on exhibition at the quantity surveyor's office. The estimate and contract, however, place upon the contractor the obligation to complete the building in accordance with the plans and specifications for the amount of the estimate. It is obvious that if the estimate is computed upon the basis of the bill of quantities, the bill of quantities should also constitute the basis of the contract. The lump sum tender should be done away with.

As stated before, the quantity surveyor in England is employed by the architect and paid by the contractor. Payment generally signifies employment; but the English courts have, in only a very few cases, held the quantity surveyor responsible to the person paying him for his services, and in these cases only because he has been guilty of flagrant negligence or gross incompetence. Such a condition will always have the tendency to induce irresponsibility in the quantity surveyor.

As a tentative basis for working out an American quantity system, the following code of rules is proposed to govern the employment of the quantity surveyor and the adoption of the quantity system of estimating:

(1) That the quantity surveyor receive a stipulated fee to be paid in all cases by the owner.

(2) That the bill of quantities constitute the basis of the contract — a definite amount of work for a definite amount of money.

(3) That the drawings, specifications, and bill of quantities be issued for the purpose of bidding. The drawings and specifications are essential to the intelligent pricing up of the bill of quantities, since they serve to illustrate the manner in which the materials are to be worked and their character.

(4) That the owner assume responsibility to the contractor for the accuracy of the bill of quantities.

(5) That the quantity surveyor be obliged to pass a state examination and receive a certificate, as does the certified public accountant, before he be permitted to practise, thus establishing his competency.

Let us now consider the various aspects of the operation of the quantity system under the proposed code.

The owner may be expected to object to being put to the supposed additional expense of the quantity surveyor's fee. This objection is quickly disposed of by studying the economies of the present system. Sufficient statistics have been collected to indicate that in this country there is an average of ten bidders for each job put out for estimate. Following the law of averages, each bidder secures one of the ten jobs on which he submits estimates. The cost of preparing all estimates is charged to "overhead" and distributed pro rata over all of the work actually secured. Therefore, the cost of estimating the nine jobs lost is charged against the one job secured. No matter what obscure method of bookkeeping is followed, in the last analysis the fact remains that the owner of the tenth job pays the cost of estimating the other nine in which he has not the slightest interest. Through the adoption of the quantity system the bidders are relieved of the cost of preparing estimates, and the owner pays the cost of the estimate for his own job only.

One of the most certain, far-reaching, and beneficial effects of the quantity system will be the production by the architect of more accurate and intelligible drawings and specifications. The improvement must result from the full and frank co-operation between the architect and the quantity surveyor, in the preparation of drawings and specifications, and from them of the bill of quantities. As already shown, accurate quantities cannot be taken from deficient drawings and specifications. The quantity surveyor will apply to the architect for information on all points not made clear by the drawings and specifications. Is it possible to conceive of a more thorough check for accuracy and clearness? Conversely, with such co-operation, it must follow that the bill of quantities can be prepared with a far greater degree of accuracy than is now possible.

Each contract should include a clause providing that — the work comprehended in the agreement consists of the quantities of the various materials comprising the bill upon which the bid is based, worked in accordance with the requirements of the accompanying drawings and specifications.

Each contract should also include a clause providing for increased or decreased compensation to the contractor resulting from additions to, or deductions from, the original bill of quantities due to any cause or by reason of subsequent changes in the work, at the rate of the unit prices

set forth or deducible from the bid, plus ten per cent for additions, and at the rate of the unit prices set forth or deducible from the bid, less ten per cent for deductions; also for priced bills of quantities on extra work involving the use of materials differing in character from any of those originally billed.

In other words, the basis of the contract should be so flexible that it may be extended to cover deficiencies or contracted to cover excesses in the original bill of quantities, and so that it may automatically adjust itself to provide for changes in the work, always upon a fair and equitable basis.

If the quantities constitute the basis of the contract, and the contract prices for the various classes of materials automatically adjust themselves to the changes in the quantity and the changes in the work, there can be no dispute between the architect and the contractor over extras and deductions — and there should be none.

Nevertheless, since extra work carries with it a pro rata increase in profit, it is reasonably certain that a great number of contractors will endeavor to establish claims for extra compensation on the basis of alleged deficiencies in the original bill of quantities. If all such allegations can be reduced to questions of fact, through the establishment of standard rules and units for the measurement of executed work, there will be little chance, unless the architect is extremely negligent, for the contractor to prove a claim for excess quantities if they do not exist. The establishment of such standards as a preliminary step to the adoption of the quantity system is essential to the system's successful operation. Every thousand common brick billed must mean the same number of cubic feet of wall to each and every bidder, to the quantity surveyor, and to the architect. The work of establishing such standards will be taken up by the Association of United States Quantity Surveyors through committees in each trade. The standards so established will be based upon the best and most equitable practice in each trade, with due regard for the distinctions now made between the various classes of work. A bill of quantities drawn upon the basis of such standard rules for measurement and classification will be entirely intelligible to the bidders, because it will recognize the same distinctions and classifications in the work that now govern them in pricing the various departments of work.

Estimating on bills of quantities will reduce competition between bidders to the sound basis of efficiency. In such competition the factors that would count would be the contractor's ability to buy at the lowest cost, his credit, rating, and capital, and the efficiency of his organization and methods in construction. The material man, who stands back of the contractor, would be fully justified in selling at minimum rates where there was no financial risk involved. The "wild-cat" contractor, the contractor without financial standing, and the inexperienced contractor would soon be eliminated. Under such competition they could no longer exist, for the work secured through taking a chance would net a loss.

The quantity system will impose upon the architect the necessity of following more precise and fairer methods in the matter of making estimates for payments. All payments will be computed upon the basis of units of materials worked, times the unit price fixed by the contract or deduced from the bid. The contractor will receive the exact amount of money to which he is entitled for the amount of work performed — no more, no less. The present method of making estimates for payments upon the basis of shrewd but "safe" guessing as to the value of the work performed, would necessarily be relegated to the past.

All those to whom the proposition has been made of establishing the quantity system have hailed it as being the solution of the one great problem in the field of building in this country, but they have also been pessimistic as to the ultimate success of the movement. However, if the architects of the country will get together and decide upon some method of procedure providing for the cooperation of the intelligent contractor, all obstacles will be overcome and there will be a greater measure of contentment in the lives of all; and that alone is well worth the effort.

It has long been a matter of wonder to those familiar with the work of the Quantity Surveyor abroad that the waste, duplication of labor, and liability to serious mistakes, incident to our haphazard methods of estimating, should be allowed to continue. It is certainly time that the babel of methods now in practice and the resultant guesswork bidding should be replaced by accurate methods generally accepted. It is our belief that a frank discussion of the general scheme proposed by Mr. Jones should result in much benefit to the entire architectural profession. Certainly it should bring to light a record of opinion on a subject which is of more than passing importance. It would appear that the advantages of the suggested system are many to all concerned, but there will be no doubt a diversity of opinion upon the subject of this appeal and we only hope that it may be our privilege of presenting in following issues of THE BRICKBUILDER *a number of contributions from other authorities which will develop a consensus of opinion to the end that something may be accomplished which will be of benefit to the profession as a whole.* — EDITORS.

The Lighting of Public and Semi-Public Buildings.

SECOND PAPER.

BY L. B. MARKS,
Consulting Illuminating Engineer, New York City.

IN this paper Mr. Marks resumes the discussion of the basic principles underlying good lighting, the following points of which were considered in our preceding issue: A. Selection of Illuminant; B. Intensity of Illumination; C. System of Illumination; D. Location of Lighting Sources; E. Types of Lighting Fixtures; F. Glare and Intrinsic Brightness; G. Regular or Specular Reflection; H. Contrast. In the present issue this is concluded with a discussion of I. Shadows; J. Esthetic Consideration; K. Economy and Efficiency. The first of the series of illustrations of specific installations, covering Court Houses, Post Offices, and City Halls, and accompanied by explanatory notes and data appears in this issue.

I. Shadows. We are so accustomed to the natural shadows that occur in daylight that we rarely notice them, yet these shadows are absolutely necessary to bring out the form and perspective of objects viewed. When we attempt, however, to imitate in artificial lighting the conditions that obtain in daylight illumination, we find that unless the character of the artificial lighting is such as to produce effects of light and shade somewhat similar to those that obtain in daylight, we are apt to fall far short of the realization of good illumination.

Steinmetz* has discussed the importance of the subject of shadow in illuminating engineering substantially as follows:

Objects are seen by differences in color and in intensity or brightness; for producing differences in intensity shadow is of great assistance, and, indeed, the differences of intensity by which objects are seen are to a large extent, those due to shadows. If the illumination were perfectly diffused and no shadows produced, then, even if the intensity of illumination were sufficient, the illumination would be unsatisfactory in most cases of lighting, because of the loss of the assistance of the shadows in distinguishing objects. Seeing under such conditions would become more difficult, and the effect of the illumination would be uncomfortable.

The use of shadows for illumination requires directed light, that is, light coming from one or a number of sources, and not merely diffused illumination coming from all directions. However, it is not sufficient to provide directed lighting only.

For satisfactory illumination it is necessary to have sufficient directed light to mark the edge of the objects by their shadow and thereby improve the distinction, but at the same time there must be sufficient diffused light to see clearly in the shadows; that is to say, a proper proportion of directed and diffused light is necessary.

In cases in which all the objects assume practically the same color, such as in flour mills or foundries, a diffused illumination without shadows would make the illumination so bad as to be practically useless. In a drafting room, on the other hand, where all of the objects requiring distinction are in one plane, and the distinction is exclusively by differences of color and intensity, but not by shadows, a perfectly diffused illumination is required and noticeable shadows would be objectionable.

The purpose of the shadow in illumination is to mark the edge of the object, and to show its height by the length of the shadow. The shadow, therefore, should not extend too far from the object to which it is related, otherwise it loses its close relation to it and becomes misleading, and therefore interferes with good illumination. Hence the directed light should come from above in a direction making a considerable angle with the horizontal, so as to limit the length of the shadow; but the light should not, however, come vertically downwards, as this direction would largely obliterate shadows and defeat their purpose.

In the use of shadows in illuminating engineering it is necessary for the outer edge of the shadow to blur or gradually to fade, and this result requires that the source of directed light should not be small, but should be sufficiently large to scatter the light at the outer edge of the shadow. This requirement necessitates the use of a diffusing globe or its equivalent so as to have the light issue from a fairly large luminous area.

J. Esthetic Considerations. Some one has stated that no design of illumination is physiologically correct unless it is esthetically good. However this may be, there is no question as to the importance of esthetic considerations in planning the artificial lighting of an interior.

The mere delivery of a definite number of foot-candles on a working plane is only a small part of the performance which the illuminating engineer must exact of his tools; indeed, this feature of the illuminating design may often be relegated to an entirely subordinate place. In purely utilitarian lighting, as in factories, the esthetic feature of the design naturally does not play as important a part in the design as in the home, the library, the theater, etc.; but even in the factory, where up to the present, esthetic considerations have been to a large extent ignored, there is reason to expect that it will actually pay to devote more attention to this phase of the subject. The eye craves the beautiful, whether it be in the salon or in the workshop.

A lighting fixture that is not in harmony with its surroundings is a fixture out of place even if it gives adequate illumination. Illumination that does not give suitable color, and suitable light and shade effects, is esthetically wrong, and therefore defective.

K. Economy and Efficiency. In planning a system of illumination, the question of economy in first cost and economy of upkeep may be a governing consideration. In fact the initial cost of the lighting equipment is commonly a limitation that is placed upon the design of the illumination. The practical problem usually is not, "What system of lighting will give the best illumination?" but "What is the best system of lighting that can be installed within the specified limit of cost?"

A mass of data has been published on the cost of illuminating interiors by different classes and types of illuminants and by different systems of illumination, but these data are very incomplete in that they do not fully set forth all of the conditions that obtain in the lighting in each case. Usually the criterion in these data is the "effect-

*C. P. Steinmetz, "Illumination and Illuminating Engineering," Transactions, I. E. S., January, 1910.

ive" lumens per watt of electric power expended or per cubic foot of gas consumed.

As has been previously stated, this value is not necessarily a criterion, and, indeed, is often far from being a criterion of the real, that is, the *ultimate* economy of lighting. No matter what the "effective" lumens on an assumed working plane may be, or whether these lumens are produced by illuminants, the first cost of which and the cost of the upkeep of which is less than that of any other, the lighting, broadly speaking, is uneconomical if the result of the illumination is physiologically bad.

The switching arrangements constitute an important feature in the economy of use of light. Economy is furthered (*a*) by the facility with which lamps may be lighted or extinguished, and (*b*) by the separate control of individual lamps or groups of lamps. Thus, for example, if the control of a lamp or lamps is conveniently located, the user will be more apt to extinguish the lamp that is periodically used during the day than he would be if the control were remote. Again, if the natural light at the further end of a room is insufficient in waning daylight, while the light near the windows is sufficient, the user may economize in lighting if the lamps at the windows are grouped under separate control, thus permitting the lighting of lamps in the darker portions independently. Similarly, in large interiors, the separate control of a pilot-lighting circuit that is intended to give only a very moderate illumination after hours of regular use, for cleaning purposes and the like, often results in considerable economy of lighting. Even in the dining room of the residence the separate control of a lamp of small candle-power, giving just sufficient light for setting the table, is a factor in the economy of lighting.

EFFICIENCY OF ILLUMINATION.

In illuminating work, starting with the illuminant, we have three technical efficiencies to consider:

(*a*) The efficiency of the lamp, that is, the lumens generated by the lamp per watt of electric power expended in the lamp or per cubic foot of gas consumed.

(*b*) The *gross* efficiency of the illuminating installation, that is, the lumens effective on a reference plane per watt of electric power expended or per cubic foot of gas consumed.

(*c*) The *net* efficiency of the illuminating installation, that is, the lumens effective on a reference plane per lumen generated. The net efficiency may be stated to be the efficiency of utilization of the light.

While the ratio of lumens delivered on the reference plane, to lumens generated, is a measure of the efficiency of utilization, this ratio is, of course, not to be taken as a complete measure of the illuminating result. The illuminating result will be affected by the specific brightness and area of the primary and secondary lighting sources within the field of view, the contrast in intensity of illumination on walls, ceiling, floor, and objects in the room, etc. As an illustration of this point it may be stated that if an indirect lighting unit, designed to throw all the light to the ceiling, were converted into a direct lighting unit by simply turning the unit upside down, the lumens delivered on the working plane might, in a specific case, be one hundred per cent greater than when the lamp and reflector are turned toward the ceiling. The efficiency of utilization in the former case may be twice that of the indirect lighting unit, but the illuminating result, if it could be expressed in terms of ability to see on the reference plane, might nevertheless be decidedly in favor of the indirect lighting unit.

In practice it is found that we may have the very worst lighting in cases in which the largest percentage of the total flux of light generated by the lamps is delivered to the working plane. Take, for example, a living room 20 feet (6 m.) long by 15 feet (4.5 m.) wide, and 10 feet (3 m.) high, with dark-colored walls, the lighting of which is carried out by a single lamp in the center of the ceiling, the lamp being housed in a deep opaque-mirrored reflector of such design as to throw the maximum light on the working plane, 2 feet 6 inches (91 cm.) above the floor. In this case no light goes directly to the ceiling or upper portions of the walls. Such a lighting design would be atrocious from the standpoint of desirable illumination, even though an extremely large percentage of the total flux of light from the lamp were delivered on the working plane. The contrast effect in illumination would be so great that under normal conditions of usage of the room the eye would quickly become fatigued.

INDIRECT AND SEMI-INDIRECT LIGHTING.

The greatly increased efficiency of lighting made possible by the introduction of improved electric and gas illuminants has led to the further development of indirect systems of illumination, both electric and gas, and has brought to the foreground the discussion of the merits and shortcomings of this method of lighting.

In the system of illumination known as "indirect lighting," the primary lighting source is concealed from view, and the illumination from it derived wholly from reflected light from the ceiling and walls, which become the secondary lighting sources. Indirect lighting may be carried out by lighting sources disposed in coves located near the ceiling, at the sides or in the central portion of a room.

Another method of indirect lighting which has come into more or less prominence within the past few years is carried out by lighting units hung from the ceiling, the lamps being concealed from view by an opaque backing. This is the system to which the following discussion, for the most part, relates. In carrying out this system the lamps are backed by powerful reflectors pointed toward the ceiling. Usually the lamp and its reflector are contained in an opaque basket or bowl. The lighting unit may consist of a single lamp and reflector or of a number of lamps and reflectors all mounted in the same housing.

The intent of the design of this system of lighting is to totally conceal the primary lighting source from view, and to throw as large a percentage of the total flux of light as possible directly to the ceiling. To make the system effective from the standpoint of illumination delivered on the working plane, light-colored ceilings are required.

Where it is desired to confine the flux of light within a small area of the ceiling, a concentrating reflector is used, and where a wider distribution is desired, a distributing reflector is used. It has been found in practice that the distance of the lighting unit from the ceiling and the distribution of flux of light may be varied within comparatively wide limits without materially altering the numerical value of the illumination intensity on the working plane.

It will be seen that the efficiency of utilization of light

FIG. I. COURT ROOM, UNITED STATES COURT HOUSE AND POST OFFICE, CHICAGO, ILL.

AT the time this installation was made tungsten lamps were not available. The court room is equipped as follows : Above the skylight 60 16 candle-power carbon filament lamps, each provided with a prismatic reflector, are evenly distributed, giving a well diffused downward light through the ground-glass skylight ; 22 16 candle-power frosted lamps are located on two main transverse ceiling beams and fitted with prismatic reflectors ; 36 8 candle-power frosted lamps are located on ceiling beams under the skylight, without reflectors ; 71 8 candle-power bare lamps are installed in the cove about midway between the floor and the ceiling. These lamps are used without reflectors and illuminate the wall space above far from uniformly. The exposed lights below the skylight beams and the cove lights are not necessary in the illumination of the room and are rarely used. The remaining illumination is secured by 8 brackets, each with 4 8 candle-power frosted lamps and 1 32 candle-power lamp in opalescent flame-tip shade, and 4 double brackets with twice the lamp equipment mentioned. The resultant illumination from the lamps above the skylight, studded lamps on ceiling beams and from the brackets is both adequate and satisfactory. The reflection value is high, the finish being in white marble and plaster. The lighting equipment is typical of that in four similar court rooms on the same floor.*

Data :

Floor Area	*3,320 sq. ft.*
Ceiling Height	*25 ft.*
Watts per square foot (Carbon Filament Lamps)	*3.25*
Total Candle-Power of Lamps. (Horizontal Rating)	*3,192*

(NOTE.—If carbon lamps are replaced by tungsten lamps of same candle-power. the watts per square foot will be reduced to about one third the value above given.)

*See Paper by J. E. Woodwell. Trans. Illum. Eng. Soc., Vol. 1, 1906.

FIG. II. CORRIDORS AND MAIN STAIRWAY, CITY HALL, PROVIDENCE, R. I.

A METHOD of lighting by suspended clusters of lamps backed by prismatic reflectors.

FIG. III. CORRIDOR, FEDERAL BUILDING, CHICAGO, ILL.

THE illumination is carried out by lamps mounted in the rosettes of the ceiling arches.

is greater when the illumination is carried out by this method of indirect lighting than would be the case in ordinary indirect lighting by coves, because with ordinary cove lighting the bulk of light from the lamps suffers at least two reflections, one from the ceiling and one from the walls, before it reaches the working plane; whereas, with the method under discussion the bulk of the light reaches the working plane after only one reflection, — from the ceiling. With a single reflection from the ceiling, the loss is estimated in the case of light ceilings not to exceed about forty per cent of the light reaching the ceiling. In the case of an additional reflection from the walls (assuming the walls to have the same coefficient of reflection as the ceiling) the light reflected from the ceiling to the walls would suffer another loss of about forty per cent. If the walls are dark in color this second loss might easily amount to eighty-five or even ninety per cent.

While it is true that in the earlier forms of cove lighting the design was such that a large part of the light from the lamps in the cove suffered multiple reflections before reaching the working plane, coves may be so designed that the bulk of the light will be directed to the ceiling at such an angle as to suffer only one reflection. Moreover, any desired angle of reflection of light from the ceiling may be secured by suitably designing the cove. A cove of this character was designed and installed in 1907, in the library and assembly room of the Edison Electric Illuminating Company, Boston, Mass. The description and performance of this lighting installation are recorded in the Transactions of the Illuminating Engineering Society.*

The most important point to consider in evaluating the claims of any system of lighting is, in the last analysis, the physiological effect of the lighting.

With respect to the relative brightness of ceiling, walls, and floor, we have, with the indirect lighting system, a partial inversion of the conditions that obtain in daylight illumination. With the indirect system, the ceiling is the brightest portion of the room; whereas, in daylight illumination, the floor receives the maximum flux of light.

In general, we have a directive side illumination in daylight; the light entering the interior through windows at the sides is diffused throughout the room. This diffusion does not mean that the illumination is shadowless. On the contrary, owing to the direction of the light, the objects in the room cast more or less shadow. This shadow is of great importance in distinguishing objects clearly and in giving proper perspective.

In the system of indirect lighting by suspended lighting units backed by opaque reflectors, the ceiling becomes the secondary lighting source from which the entire illumination of the room must be derived. The natural result of illumination by this character is, that the side-shadow is either absent or very faint. This condition is in striking contrast with that which obtains ordinarily in the daylight illumination of interiors.

In considering the physiological effect of lighting by indirect illumination, the proportions of the interior, as well as the use to which the interior is to be put, must be taken into consideration. For example, in a room with a very high ceiling, where the ceiling is not within the ordinary field of vision, a relatively high specific brightness of the ceiling may not be objectionable; while, on the other hand, in an interior in which the ceiling is either always, or for a large part of the time, within the ordinary field of vision of those occupying the room, the brightness of the ceiling and side walls have an important bearing on the ability to see well.

The visibility of objects depends upon a number of conditions which have already been discussed. Fundamentally, one of the most important conditions is to have a greater intensity of light on the object viewed than on the ceiling or other portions of the interior that do not require fine discernment.

A very high intensity of illumination on the ceiling and walls, when these are within the ordinary field of view, operates to decrease the visual sensibility for two reasons:

(1) Because a large surface of relatively great brightness within the field of view *per se* reduces the ability of the eye to discern darker objects on the working plane.

(2) Because the strong contrast in brightness of the ceiling and walls, and that of objects in the room, renders it more difficult to distinguish details of the objects viewed. Dark-colored objects in a room appear all the darker when the ceiling and upper portions of the room are brighter.

As an illustration of the points above raised, let us take the case of a library in the home. In daylight, in the average library, the intensity of illumination on the ceiling is small compared with the intensity of illumination on the pages of a book in the hands of a reader. In order that the walls may not constitute a secondary lighting source of relatively high brightness, they are usually finished in green or other moderately dark color which will absorb a large percentage of the light incident thereon. The reader is, therefore, not subjected to the visual strain which is incident to having a relatively bright secondary lighting source within the field of view, and his ability to read with comfort is not reduced by the contrast effect produced by a condition in which the ceiling and walls are brighter than the pages of the book.

In reading, it is desirable to rest the eyes occasionally. If, in glancing away from the book, the eye cannot escape the relatively bright ceiling or walls, fatigue of the eye sets in much sooner than when the specific brightness of the ceiling and walls is of a low order. In conversing with people seated on the opposite side of the room, the same holds true. If the general direction of the light is directly downward, as is the tendency in the indirect lighting system under discussion, the absence of shadow, or the unnatural position of the shadow, is trying to the eye.

In the case of a very large room with high ceiling illuminated by indirect lighting, the effect of the downward light is very noticeable. In such a case the directive value of the light reflected from the side walls is minimized. The eyebrow of a person standing in the center of such a room casts a comparatively strong shadow downward on the face, with the result that the features of a person may not be clearly distinguishable except at rather short range. This condition is in striking contrast to that which obtains in the same room in daylight, when the lighting of the room is carried out by side windows. To partially offset the downward shadows, the floor of the room might be finished in a light tint for the purpose of redirecting the light upward by reflection. Obviously,

*"Lighting of the Edison Building," by Louis Bell, L. B. Marks, and W. D'A. Ryan. Transactions I. E. S., October, 1907.

FIG. IV. COURT ROOM, UNITED STATES BUILDING, INDIANAPOLIS, IND.

THE principal illumination is here secured from 16 brackets of special design, supporting 4 6-inch and 1 10-inch ground-glass ball globes, the former with 16 and the latter with 32 candle-power carbon filament lamps. The brackets are 11 feet above the floor, but on account of the size of the room are within the line of vision. For this reason it was necessary to use diffusing globes, by means of which the intrinsic brilliancy is reduced to about one-seventh of 1 candle-power per square inch. There are 66 frosted lamps of 16 candle-power located under a skylight in the center of the ceiling for decorative effect, which aid materially in bringing out the details of the mural decoration. The resultant effect is satisfactory and agreeable to the eye.

Data:
Floor Area .... 2,340 sq. ft.
Ceiling Height .... 30 ft.
Watts per square foot (Carbon Filament Lamps) .. 4.3
Total Candle-Power of Lamps.
(Horizontal Rating) 3,104

(NOTE.—For tungsten lamps the watts per square foot will be about one-third the value above given.)

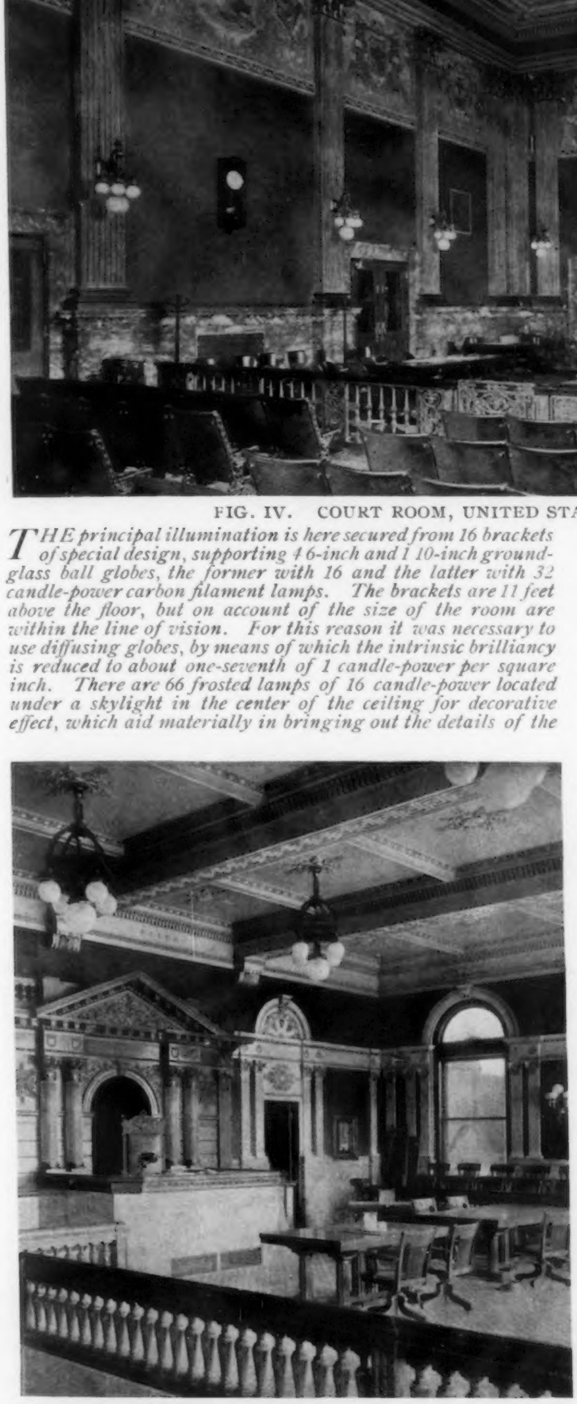


FIG. V. COURT ROOM, ONONDAGA COUNTY COURT HOUSE, SYRACUSE, N. Y.

THE illumination is carried out by pendant fixtures, each having 1 13-inch ground-glass ball globe and 4 9-inch globes, cut on the lower portion for decorative effect. The lamps in the 13-inch globes are equipped with prismatic reflectors to secure an efficient downward distribution of the light. The lowest point of the pendant is about 12 feet above the floor, but as the intrinsic brightness of the light sources is only about 1/5 of a candle-power per square inch, there is no harmful glare. The bracket lights are principally decorative.

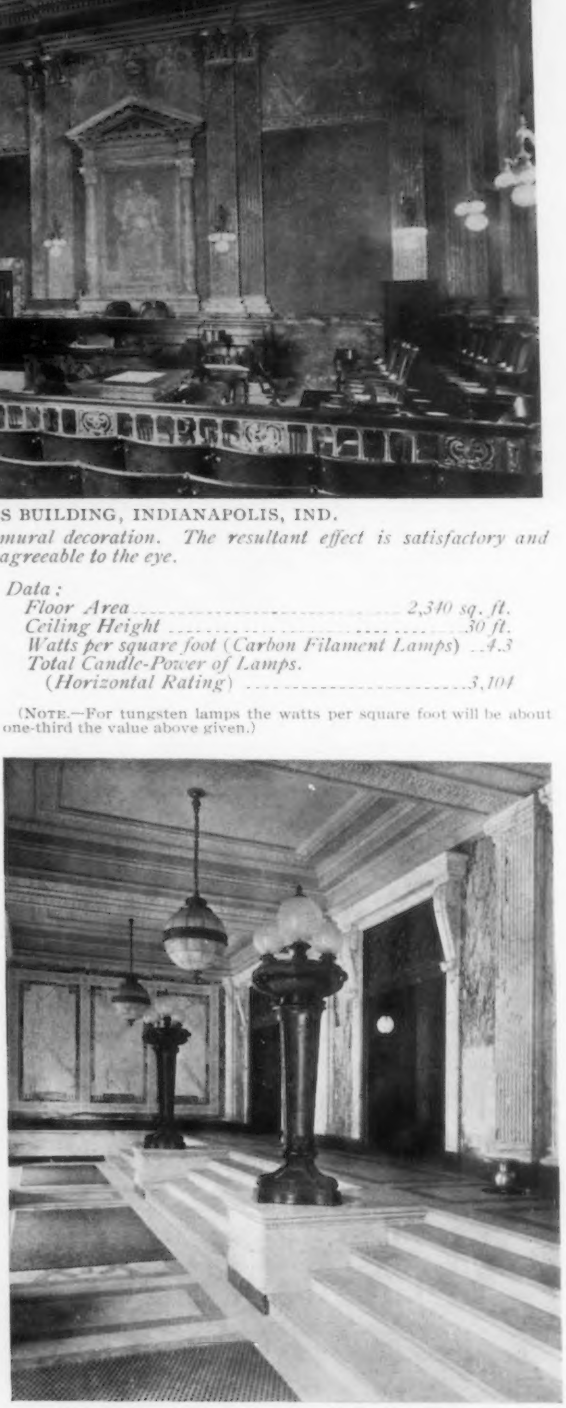


FIG. VI. ENTRANCE LOBBY, MULTNOMAH COUNTY COURT HOUSE, PORTLAND, ORE.

Data:
Floor Area .... 2,094 sq. ft.
Ceiling Height .... 18 ft. 4 ins.
Watts per square foot (Carbon Filament Lamps) .. 2.9

(NOTE.—For tungsten lamps the watts per square foot will be about one-third the value above given.)

FIG. VI. shows an entrance lobby lighted by lamps housed in diffusing glass spheres, suspended by chains from the ceiling, and by groups of lamps mounted in enclosing globes on ornamental standards.

however, such a procedure, even if otherwise practicable, would introduce an even more serious difficulty, as the light reflected from the floor, coming from an unnatural direction, would produce visual fatigue.

In considering the effect of light upon the eye, cognizance must be taken not only of the specific brightness of the primary or secondary lighting sources within the field of view, but also of the area of these sources. It has been demonstrated that of two lighting sources having the same specific brightness, that source which has the greater area exposed to the eye will produce the greater glare.

Absolute uniformity of illumination is desirable only in a few instances in practice. With rare exceptions, a variation in the intensity of illumination in different parts of a room is desirable. Take, as an example, an extreme case in which an object is illuminated equally in all directions; it loses form and detail when viewed.

Mr. J. R. Cravath, in a report of tests of indirect lighting,* calls attention to some essential points to be borne in mind in the application of indirect lighting from suspended chandeliers. He states that the efficiency of such a system will depend largely on the proportion of the light which is reflected directly from the ceiling to the working plane. He advocates the system of indirect lighting by central chandeliers, in which system the lamps are backed by opaque-mirrored reflectors, and the bulk of the illumination obtained by reflection from comparatively limited areas of the ceiling. Comparing the effectiveness of direct and of indirect lighting he comments as follows:

"We all recognize that illumination is more a physiological problem than a physical one. Foot-candle values are worthless unless the lighting equipment is so arranged as to enable us to see objects with the greatest comfort consistent with the wattage used. Many arguments both for and against indirect illumination have been advanced which have been based largely on opinions or prejudices not justified by investigation, experience, or scientific research. All will probably agree that a sufficiency of diffused daylight is likely to be more satisfactory than any artificial lighting system that we are likely to devise for many years to come. Where this is not true, it is usually because of the insufficiency of the daylight. The first question to be asked regarding any system of lighting is, therefore, as to how nearly it approaches daylight in its effects. The illumination produced by a system of indirect lighting like that upon which these tests were made may be compared to that received by daylight from a rather dense skylight. It differs from such daylight mainly in intensity and color. The general diffusion and shadow effects are much the same. It differs from daylight received through windows mainly in the angle at which light is received and in its intensity and color. In our so-called direct lighting systems we really have a combination of direct lighting and indirect lighting, part of the light being received direct from the source and part by reflection from ceilings and walls. Direct lighting differs from the indirect lighting scheme under discussion in that the shadows produced by the direct are much sharper. In this way the direct is somewhat like direct sunlight, but it certainly is not like diffused daylight as received through a window or skylight. Both diffused daylight and the indirect system under discussion produce shadows, but they are not marked."

Mr. Cravath reports that the specific consumption of electric power in the above tests of indirect lighting was:

	Watts per effective lumen
Light-colored ceiling and walls	0.35
Light-colored ceiling and dark walls	0.45

Comparative Data for Direct, Indirect, and Semi-Indirect Lighting.

From the data of the tests it appears that the net efficiency, that is, the ratio of the lumens effective, to the total lumens generated was approximately thirty-six per cent for light-colored walls and twenty-eight per cent for dark-colored walls. Compared with commercial systems of direct lighting employing efficient reflectors, the above values indicate that for the same type and candle-power of lamp the indirect system requires, in general, at least fifty to seventy-five per cent more power for equivalent effective illumination than the direct system. The effective illumination referred to above is taken as the mean illumination on a horizontal plane 2 feet 6 inches (91 cm.) above the floor. The figures given refer to new lighting installations, with clean lamps and reflectors. As the lamps and reflectors of the indirect lighting system point toward the ceiling, the more rapid deterioration due to dust must be considered in comparing the "working" efficiency with that of the direct system.

Practically all systems of general illumination by direct lighting may be looked upon as a combination of direct and indirect lighting, as part of the light comes directly from the primary lighting source, without any reflection, and part from the secondary lighting source, namely, the ceiling and walls, after reflection.

The distinguishing difference between the direct and the so-called indirect system of lighting is, that in the indirect system none of the light from the primary source reaches the floor until after reflection from the ceiling or walls or both.

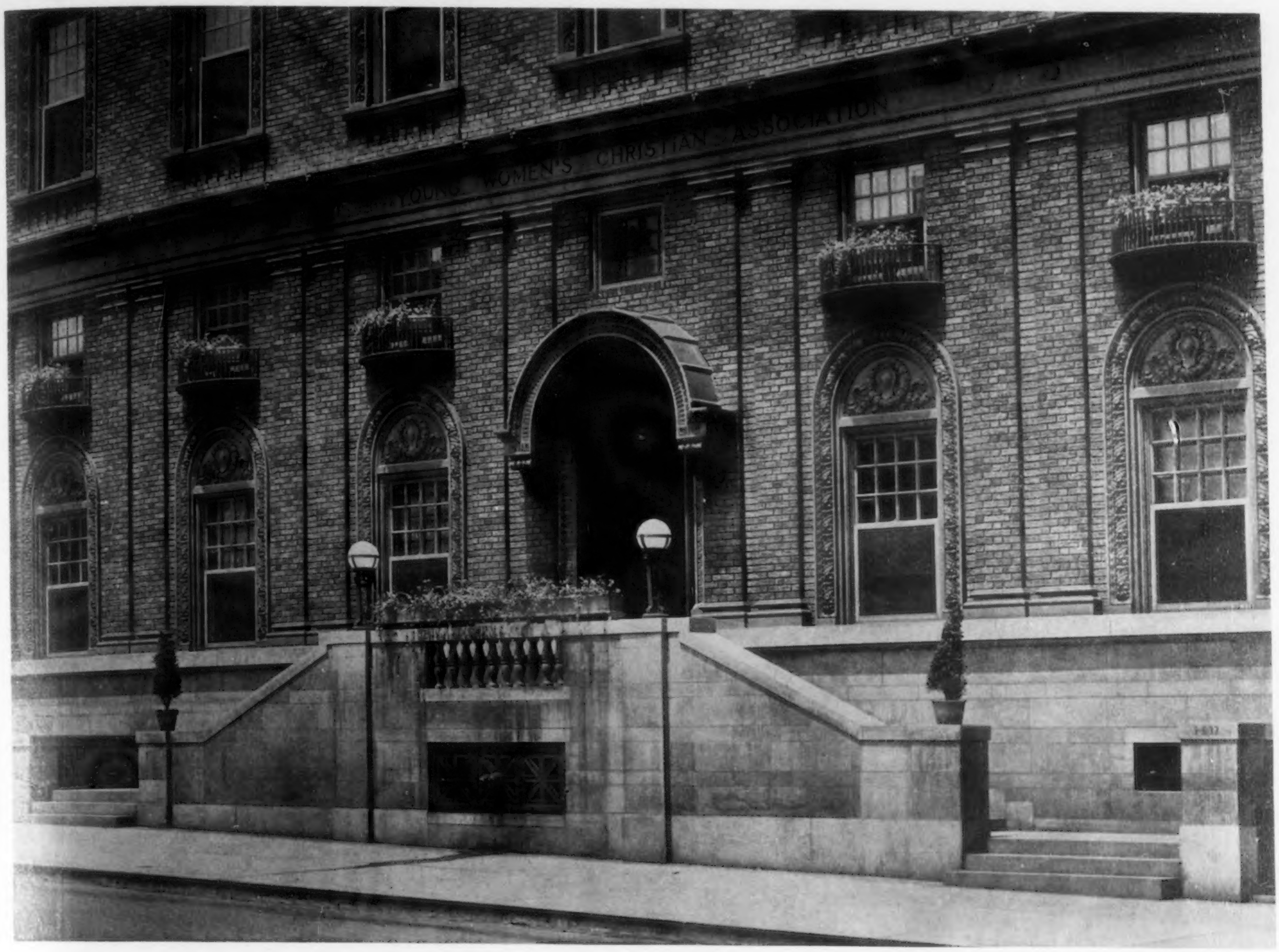
The so-called semi-indirect system of lighting is a compromise between the indirect system and the extreme forms of direct lighting. In the semi-indirect system the lamps are placed in bowls of diffusing glass, which reflect upward part of the light as in indirect lighting and let through part as in direct lighting. Usually the glass is made dense enough to let through not more than twenty per cent to forty per cent of the light, the intent being to send the major portion of the light rays to the ceiling. In this way the intrinsic brightness of the lighting source may be kept within safe limits without reducing the net efficiency of the system to that of the indirect system. The net efficiency of some of the semi-indirect lighting installations recently installed lies about midway between that of strictly direct lighting and totally indirect lighting.

To overcome some of the objections that have been raised, on the score of appearance, against the system of totally indirect lighting by suspended chandeliers, the manufacturers of these fixtures have placed on the market luminous bowl indirect lighting units. These units are identical in design with the standard indirect lighting fixtures, except that provision is made for lighting the bowl of the fixture either by transmitted light from the main lighting unit or by light from an auxiliary lamp in the bowl.

*Some Notes and Tests on Indirect Illumination. J. R. Cravath. Trans. I. E. S., April, 1909, p. 290.

J

Y. W. C. A. BUILDING, ST. LOUIS, MO.
MARINER & LA BEAUME, ARCHITECTS



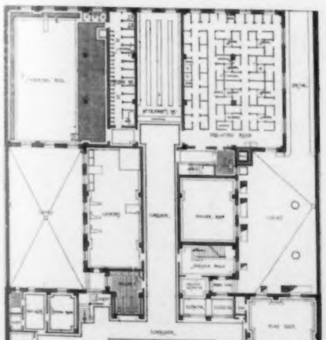
DETAIL OF FACADE

Y. W. C. A. BUILDING, ST. LOUIS, MO.

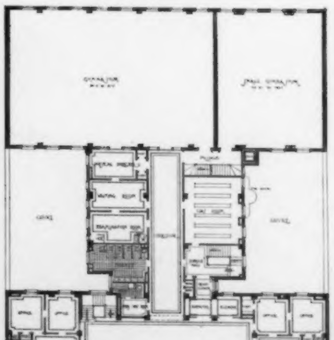
MARINER & LA BEAUME, ARCHITECTS

FOURTH FLOOR PLAN

FIFTH FLOOR PLAN

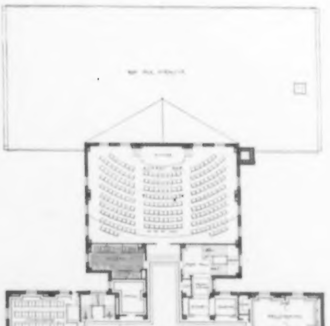


BASEMENT PLAN



FIRST FLOOR PLAN

SECOND FLOOR PLAN

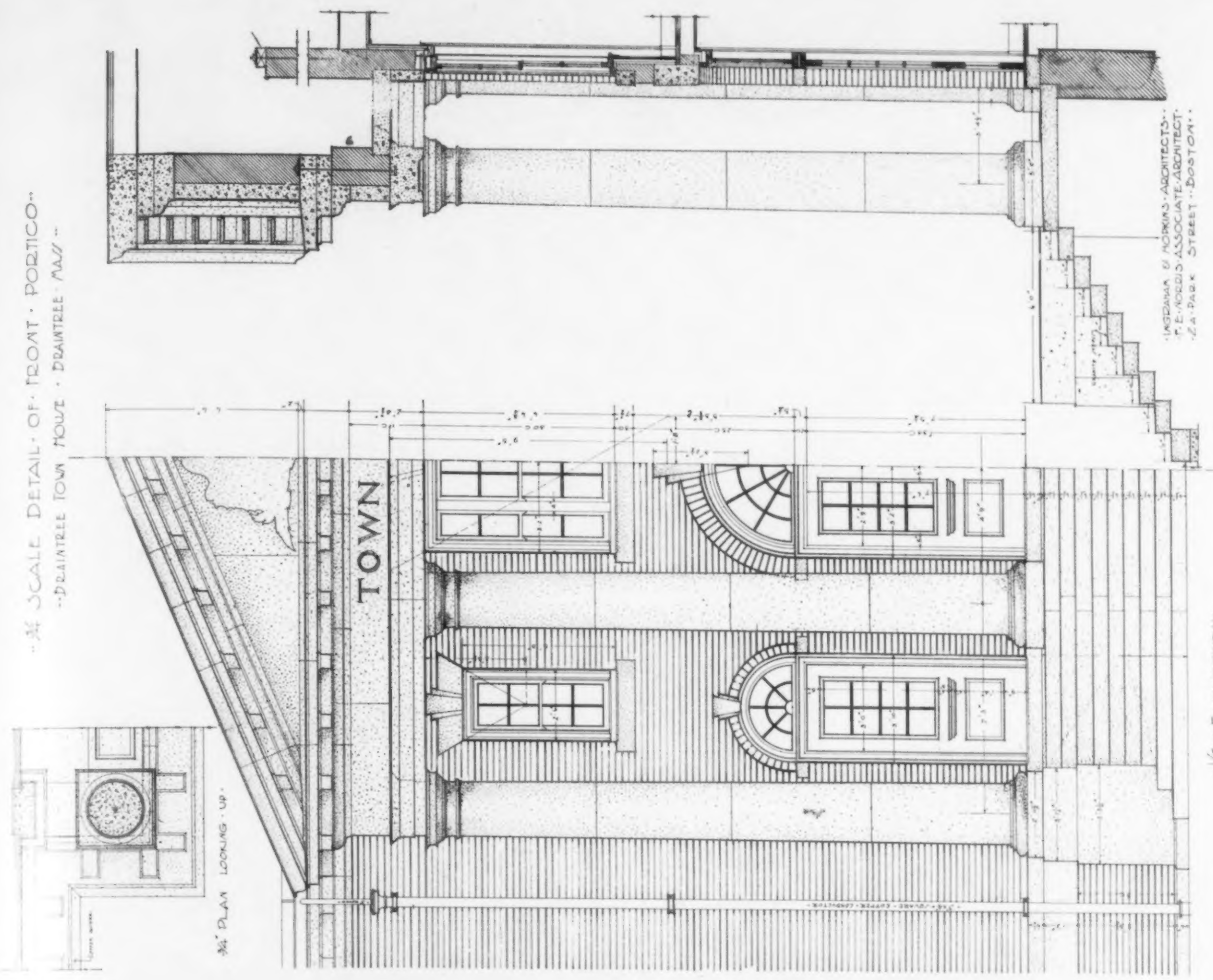


THIRD FLOOR PLAN

TOWN HALL, BRAINTREE, MASS.

INGRAHAM & HOPKINS, ARCHITECTS

F. E. NORRIS, ASSOCIATE ARCHITECT

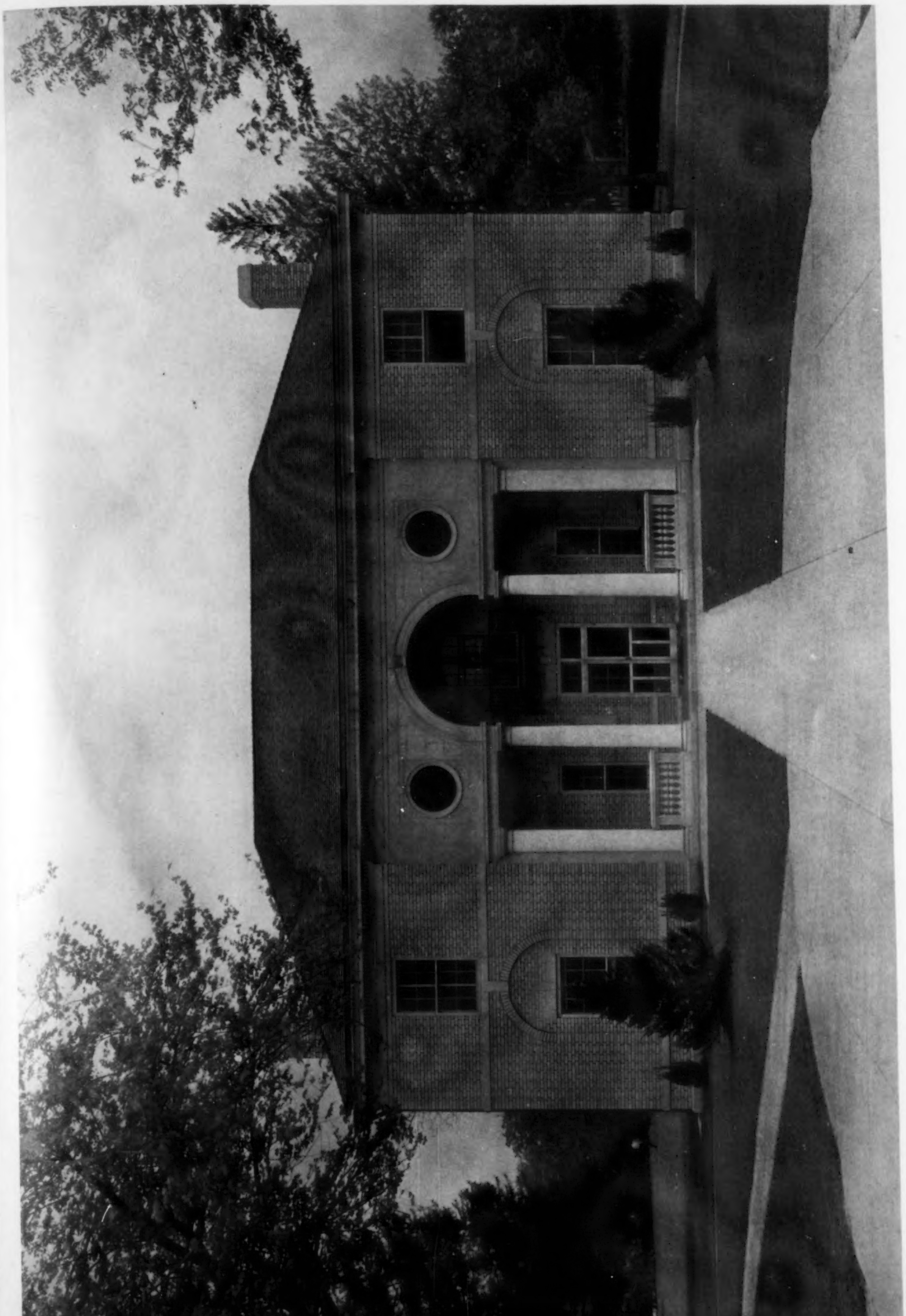


DETAILS OF FRONT PORTICO

TOWN HALL, BRAINTREE, MASS.

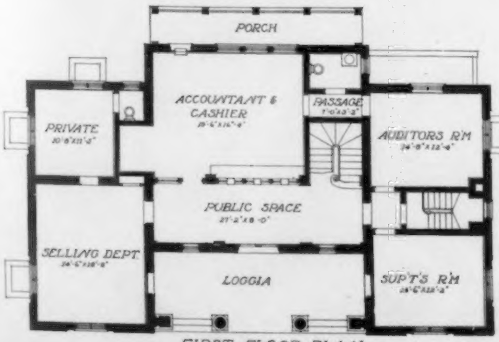
INGRAHAM & HOPKINS, ARCHITECTS

F. E. NORRIS, ASSOCIATE ARCHITECT



SMALL OFFICE BUILDING, GARDEN CITY, LONG ISLAND
FORD, BUTLER & OLIVER, ARCHITECTS

DETAIL OF LOGGIA



FIRST FLOOR PLAN

SMALL OFFICE BUILDING
GARDEN CITY, LONG ISLAND
FORD, BUTLER & OLIVER, ARCHITECTS

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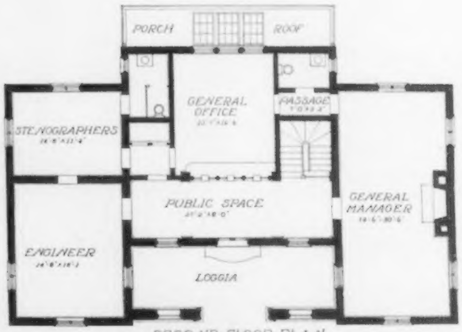
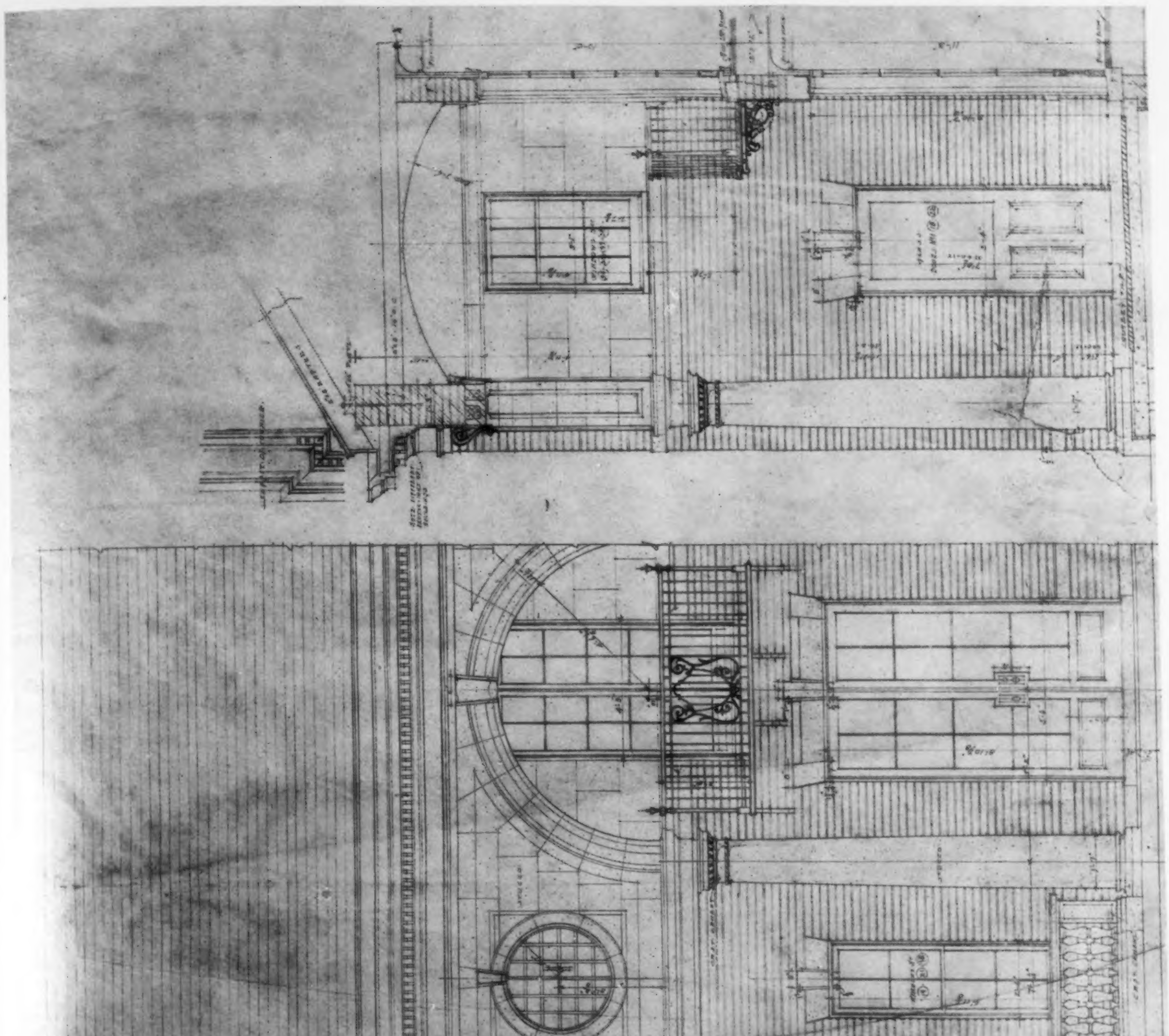
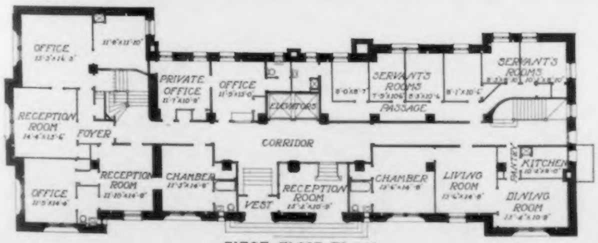


SECOND FLOOR PLAN

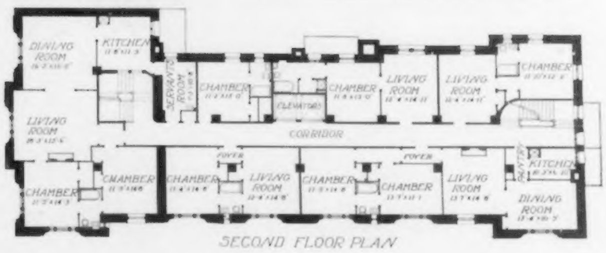


DETAILS OF PRINCIPAL ELEVATION

SMALL OFFICE BUILDING, GARDEN CITY, LONG ISLAND
FORD, BUTLER & OLIVER, ARCHITECTS



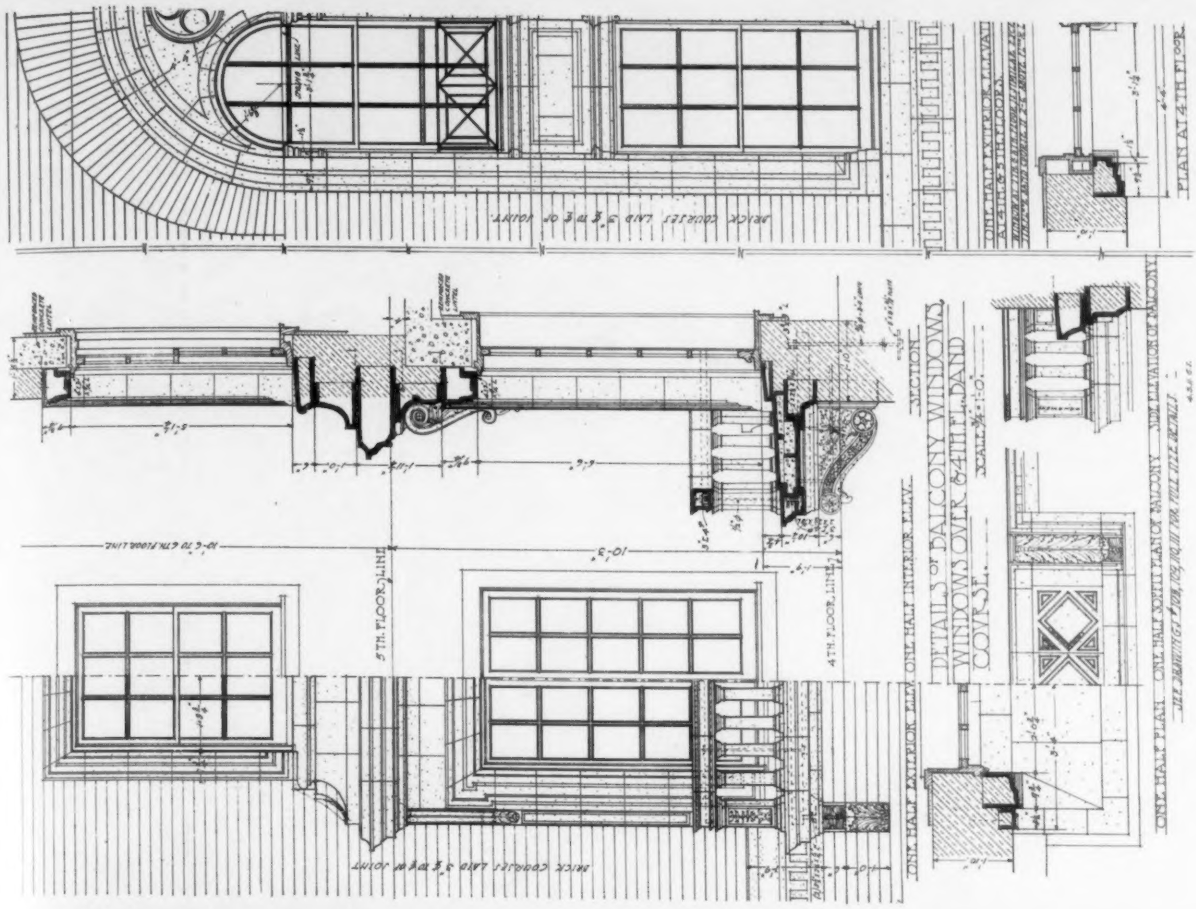
FIRST FLOOR PLAN



SECOND FLOOR PLAN

THE LATROBE APARTMENTS, BALTIMORE, MD.

E. H. GLIDDEN & C. N. FRIZ, ARCHITECTS

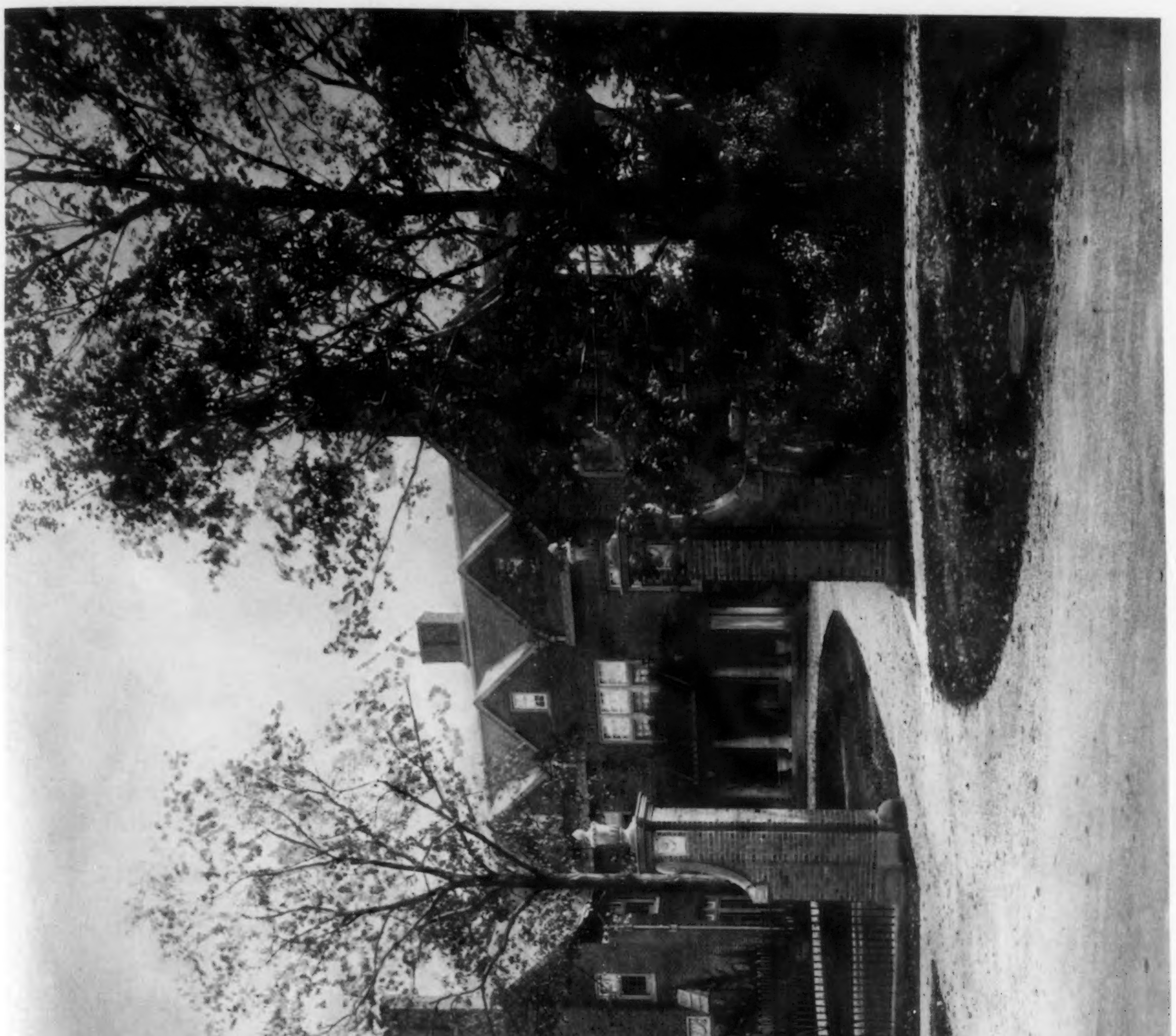


DETAILS OF WINDOW OPENINGS

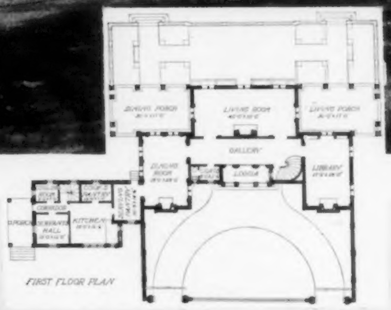
DETAIL OF ENTRANCE

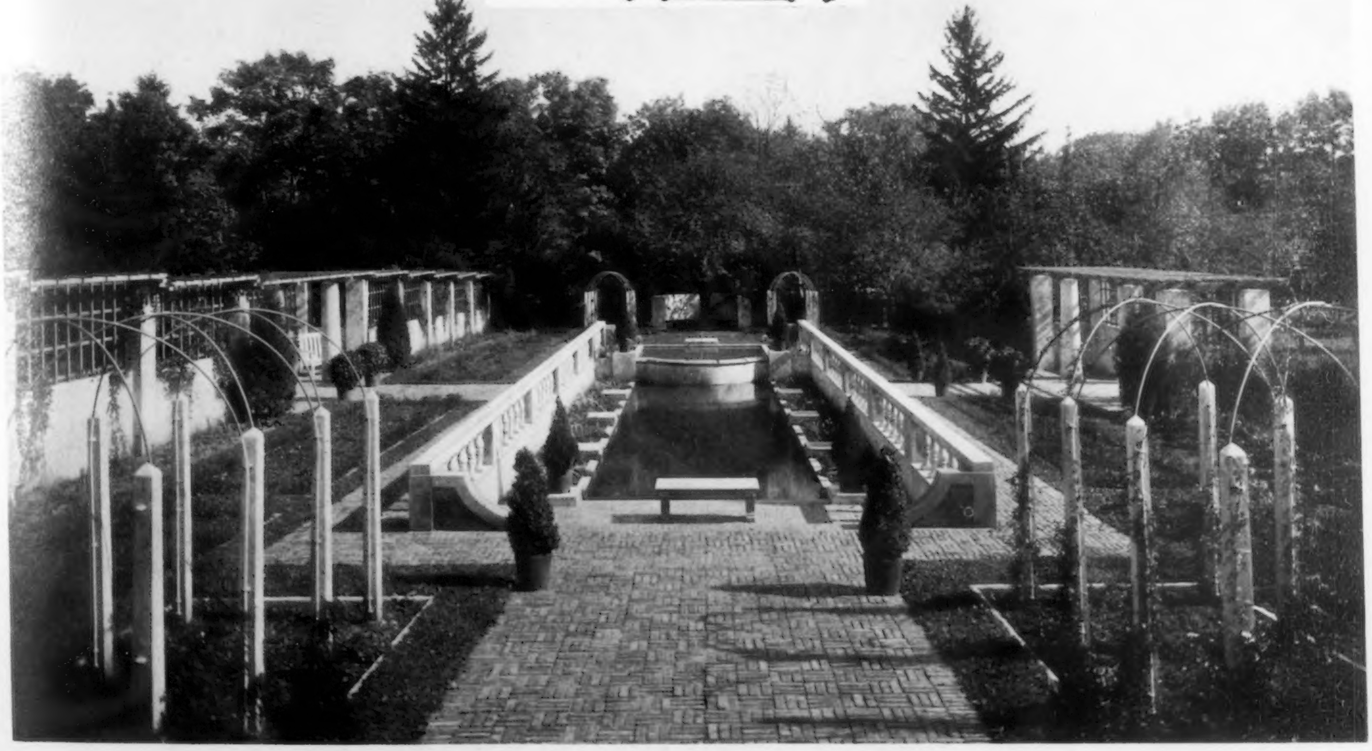
THE LATROBE APARTMENTS, BALTIMORE, MD.

E H GLIDDEN & C N FRIZ, ARCHITECTS



HOUSE AT LAKE FOREST, ILL.
HOWARD SHAW, ARCHITECT



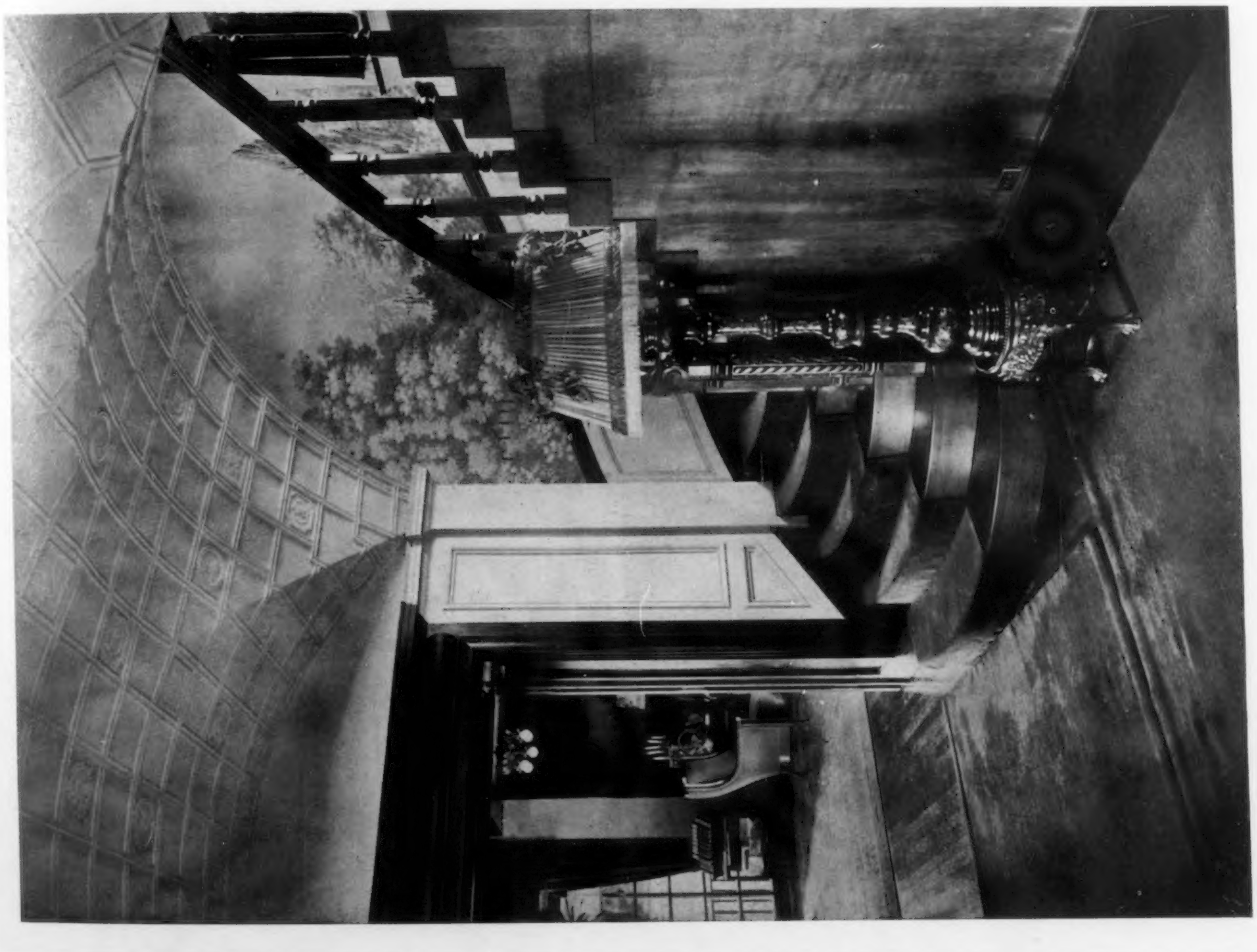


U of M

HOUSE AT LAKE FOREST, ILL.

HOWARD SHAW, ARCHITECT

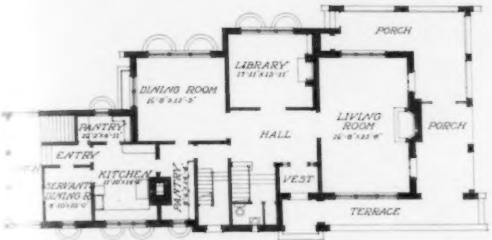
LIVING ROOM MANTEL



MAIN STAIRWAY

HOUSE AT LAKE FOREST, ILL.
HOWARD SHAW, ARCHITECT

HOUSE AT BRENTMOOR, ST. LOUIS, MO.
HOWARD SHAW, ARCHITECT



FIRST FLOOR PLAN

SECOND FLOOR PLAN

HOUSE AT SHAKER HEIGHTS, CLEVELAND, O.

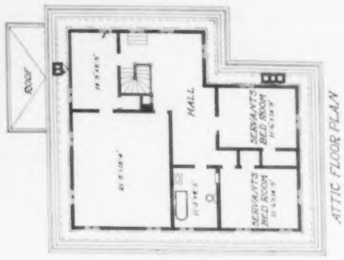
WALKER & WEEKS, ARCHITECTS

U of M

HOUSE AT EVANSTON, ILL.

SHEPLEY, RUTAN & COOLIDGE, ARCHITECTS

LIVING ROOM



ATTIC FLOOR PLAN

SECOND FLOOR PLAN

FIRST FLOOR PLAN

HOUSE AT EVANSTON, ILL.
SHEPLEY, RUTAN & COOLIDGE, ARCHITECTS

ENTRANCE DETAIL

Architectural Acoustics.

THE EFFECT OF A SPEAKER'S VOICE IN DIFFERENT DIRECTIONS.

BY HUGH TALLANT.

ANY layman would probably admit that at a given distance the effect of a speaker's voice is much louder in front of him than behind him. Any baseball fan would undoubtedly assert that the shouts from the opposite bleachers always seem more vociferous than those from his own side of the field, and there is a rumor that a Harvard enthusiast was once guilty of the remark, "I always sit in the Yale stands so as to hear the Harvard cheering." Yet the average text-book on "Physics" does not even hint that the effect of speaking or music may vary with the *direction* as well as with the *distance* from which it is heard, and even such advanced treatises as Lord Rayleigh's "Theory of Sound" are scarcely more explicit."*

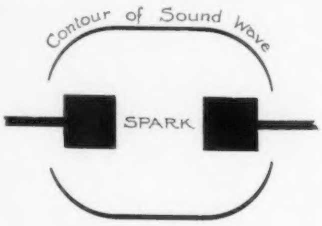


FIG. I.

FIG. II.

Variation with direction — as it may be called to distinguish it from variation with distance — is nevertheless a matter of practical as well as theoretic interest. It has long been recognized by nautical authorities in connection with the sound of whistles, sirens, bells, and other means of communication and warning. It also has much to do with the proper relative position of the members of an orchestra or a chorus. In architectural acoustics, in particular, it has an important bearing upon the grouping of an audience, the arrangement of sound-reflecting surfaces, and the necessary precautions against indistinctness and echo. A complete discussion of these various phases of the subject would, however, far transcend the limits of the present essay, which will merely try to explain why and how the effect of a speaker's voice is apt to vary in different directions.

Broadly speaking, the effect of a sound-wave depends upon four considerations: namely, the surrounding conditions; the distance from the source of the wave; the shape of the wave; and the relative intensity at different points on the wave. The present inquiry is not concerned with either the surroundings or the distance from the source, and therefore narrows itself down to a question of shape and relative intensity. With regard to the shape of the waves which constitute the human voice, no definite information or authentic statement is at present on record — at least so far as the writer is aware. Numerous diagrams and photographs of analogous waves have, however, been published by Prof. Robert W. Wood,† Prof. Arthur H. Foley,‡ Mr. William H. Souder, and others. With regard to the relative intensity at different points on a voice-wave, recent calculations by Prof. G. W. Stewart§ furnish accurate information concerning theoretic conditions closely approximating those of ordinary speech. The above data, together with certain inferences drawn from practical observation, will form the basis of the following discussion.

While, as has just been mentioned, the precise shape of voice-waves has yet to be determined, a plausible inference may be drawn from the existing photographic records. Without attempting to describe the way in which these wonderful negatives are obtained, it may be mentioned that, as sound-waves are merely irregular compressions of the air, they deflect the light passing through them and would, therefore, be visible (like hot air rising from a chimney or radiator) if they did not move too fast to be caught by the eye under ordinary conditions. They may, however, be seen under special laboratory conditions, and may readily be photographed. The waves found convenient for this purpose are produced by an electric apparatus which gives them the shape of a cylinder with rounded ends. Seen from the side, they appear as in Fig. I. From the end they appear as in Fig. II.

Four actual photographs of such sound-waves — for which the writer is indebted to Professor Wood — are reproduced in Fig. III. They illustrate the successive positions and shapes assumed by a sound-wave in moving downwards against a small, black obstacle, which will be seen in the center of each picture. The special point to be noticed is that, after the wave has passed the obstacle, its torn edges extend sideways, by the process known as diffraction, until they not only close the gap but actually overlap one another. This extension and overlapping will be clearly shown in the picture marked "D"; which, for convenience, has been redrawn in the form of a diagram, in Fig. IV. Here the source of the sound is indicated at S and the obstacle at A B. The main portion of the wave is represented by the curved lines C D and F G, which, as might be expected, are arcs of a circle with S as a center. *But the extension D E is in the form of an arc with A as a center and the extension G H is in the form of an arc with B as a center.*

This law of the extension or diffraction of sound-waves

*A theoretic discussion of the effect of a speaking trumpet in different directions is contained in Chapter XIV, Section 291, of "The Theory of Sound." The conclusions have been practically verified by Professor F. R. Watson.

† A full description of the apparatus and method by which he obtained his records is given by Professor Wood in his article on "The Photography of Sound and the Demonstration of the Evolution of Reflected Wave-Fronts with the Cinematograph," published in the Annual Report of the Smithsonian Institution for 1900, pages 359 to 369.

‡ Thirty wonderful photographs and a description of the apparatus by which they were obtained are given by Professor Foley and Mr. Souder in their article on "A New Method of Photographing Sound-Waves," published in the *Physical Review* for November, 1900.

§ These calculations are given by Professor Stewart in his article on "The Acoustic Shadow of a Rigid Sphere with Certain Applications in Architectural Acoustics and Audition," published in the *Physical Review* for December, 1911.

is of particular interest in the present connection because it suggests how a sound-wave would move on leaving the lips of a speaker. Let us imagine, first of all, what would happen in the case of a sound issuing from a small opening in the center of a flat surface. These conditions are supposed to be represented by Fig. V. Here B C is the flat surface and S the small opening. The sound-wave would naturally expand in the form of a hemisphere which is represented by the semicircle V W X. In the course of time, however, the wave will expand beyond the limits of the flat surface, as shown in Fig. VI, and the loose edges of the wave will extend by diffraction in the form of the arcs U V (of which B is the center) and X Y (of which C is the center). In course of time the diffraction might even extend so far as to cause the wave to overlap itself as shown in Fig. VII, so that a person stationed directly behind the surface at such a point as P might be able to hear the sound, although a person at the point Q, nearer the surface, would probably hear nothing.

FIG. III.
A reproduction of four sound-waves actually caught by camera.

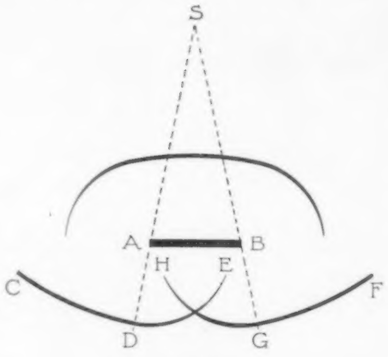


FIG. IV.

Let us now imagine that the surface, instead of being flat, had been bent as shown in Fig. VIII. The sound-wave would then have assumed the shape represented by the curve T U V W X Y Z, of which T U is an arc with A as a center, U V an arc with B as a center, V W X a semicircle with S as a center, and so on. If the surface had been bent still further as in Fig. IX the sound-wave would have again corresponded, as shown, and in the case of a cylinder, Fig. X, would have been of very similar form. Finally, if we suppose that the circle in Fig. X represents not a cylinder but a sphere, or, better yet, the contour of a man's head, and that the small opening represents the man's mouth, we shall have arrived at conditions approximating those of ordinary speech.

Under these conditions it is evident that the sound-wave would be symmetrical with reference to the line U S W. In other words, it would be the surface obtained by spinning the curve T U V W X U Z about U S W, and would be shaped very much like an apple — round in front, flattened behind, with a dent in the center corresponding to the point where the stem of the apple would have been attached. Assuming this to be approximately the form developed by the wave of a speaker's voice, we can draw some very interesting conclusions with regard to the effect which such a wave might produce upon hearers in different directions.

In the first place it is obvious that the sideways extension or diffraction of the wave must diminish the intensity in the adjacent portions of the wave. We may, therefore, infer that the intensity of the *sound* would be greatest directly in front of the speaker, at the point W, and would diminish continuously from W to X, U, and Z on one side; and from W to V, U, and T on the other. The loudness of the *effect* might, however, vary in a very different way. While it would necessarily diminish from W to X and N, it might actually increase from N to U because between these points the ears of the hearer are struck by two wave-fronts, N U and T U; and the combined effect of these two might be greater than the effect produced by the single wave-front X N. There are accordingly three possibilities. If the intensity decreases at the same rate from N to U that it does from U to T, the effect between N and U will be uniform; that is, it will be just as loud directly behind the speaker as a little to either side. If the intensity decreases faster from N to U than from U to T the effect will be fainter at U than at N. If, on the contrary, the intensity decreases more slowly from N to U than from U to T (and this would seem the most probable contingency) the effect will actually be louder directly behind the speaker than for a short distance on either side, and the direction of minimum intensity will be M N and not M U.

These generalities, while interesting, are, however, of little practical value. What the architect requires is specific facts and figures. These are provided by the series of calculations which have already been mentioned. Through the courtesy of Professor Stewart the results of these calculations are given in tabulated form in Figs. XI and XII.† In these tables the vertical distance represents the intensity, which is assumed to be 100 at the point directly in front of the speaker. The horizontal distances represent the angle at which the hearer is supposed to stand with reference to the direction in which the speaker is facing. An angle of 90 degrees would thus correspond to a position on the right or left of the speaker, while an angle of 180 degrees would correspond to a position directly behind him.

Fig. XI shows the variation in intensity of a sound of the pitch of middle C at three different distances from the speaker. The bottom curve represents the variation at a distance of 7 or 8 inches; the middle curve at a distance of about 15 feet; and the top curve at a distance of

* See the article "On Acoustics as Applied to Public Buildings," by Professor Joseph Henry, published in the Annual Report of the Regents of the Smithsonian Institution for the year 1856.

about 60 feet. All of these curves indicate a slightly smaller intensity to right and left of the speaker than behind him. They also show that while the reduction in intensity from front to rear is very great in the immediate vicinity of the speaker, amounting to over ninety per cent at a distance of a few inches, it is only about twenty per cent for distances of 15 feet and upwards.

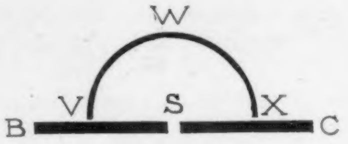


FIG. V.

It is, however, important to know how tones of different pitch may vary at a given distance. For this purpose Fig. XII shows the variation of four musical tones at a distance of 15 feet. The bottom curve represents the variation at the pitch of high C, the next above the variation at treble C, the third the variation at middle C, and the fourth the variation at bass C. The diagram, therefore, indicates that the diminution in intensity behind a speaker becomes more accentuated the higher the pitch of the tone in question.

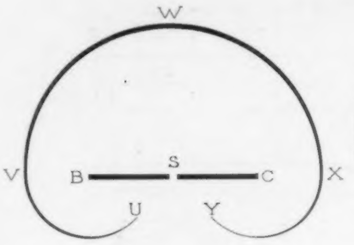


FIG. VI.

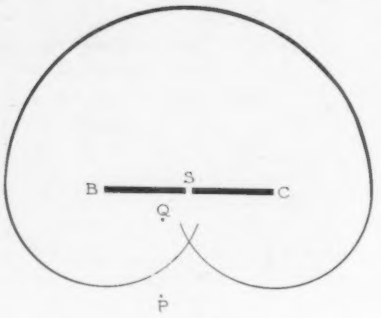


FIG. VII.

While these results are of extreme interest and value, they nevertheless cannot be considered as applying strictly to any other than the geometrical conditions upon which they are based. That is, they apply only to a sound issuing from a small opening in the side of a rigid sphere some 7 or 8 inches in diameter. In the case of a speaker they would be modified by the fact that his head would not be exactly spherical; that it would have protuberances such as nose, ears, and, usually, hair; and that it would be supported upon a neck and shoulders. These incidental obstructions might naturally be expected to interfere with the free diffraction of the sound-wave, and in this way occasion a still greater diminution in the intensity behind the speaker. It would, therefore, be desirable to compare and check the theoretic calculations with practical experiments.

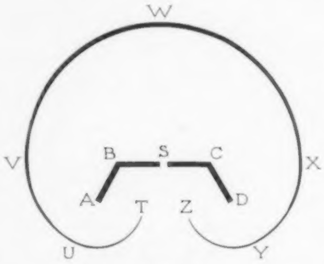


FIG. VIII.

The most authoritative record of actual observation with which the writer is familiar is given in an article written half a century ago by the then famous acoustic authority, Professor Joseph Henry.* The statement is short and may, therefore, be quoted verbatim.

"A person speaking is heard much more distinctly directly in front than at an equal distance behind. Many experiments have been made on this point, and I may mention those repeated in the open space in front of the Smithsonian Institution. In a circle 100 feet in diameter, the speaker in the center, and the hearer in succession at different points of the circumference, the voice was heard most distinctly directly in front, gradually less on either side until in the rear it was scarcely audible. The ratio of distance for distinct hearing directly in front, on the sides, and in the rear was about 100, 75, and 30."

Assuming that — as stated in any standard "Physics" — the intensity of sound varies inversely as the square of the distance from its source, the intensity of a speaker's voice, according to Professor Henry's observations, would be about half as great on either side of him as in front, and only one-fourth as great behind him. This is a very much larger reduction than the theoretic calculations would suggest, even allowing for the interference of the speaker's body. It will also be noticed that only "the *ratio* of distance for distinct hearing" is given. The *actual* distance would naturally vary with the strength of the speaker's lungs. As a matter of fact, two persons of average vocal capacity can easily call to one another across a quiet lawn up to a distance of 180 feet. Satisfactory expression or modulation is, however, impossible beyond 100 or 120 feet. Of course under special conditions, and in particular, in the mountains, the radius of communication is much greater. The writer has often made himself understood across a valley over half a mile in width. In such cases, however, we have to deal with sound-reflection, and also with the tendency of sound to adhere to concave surfaces, which Lord Rayleigh believes is responsible for the peculiar effects in the dome of St. Paul's Cathedral. Indoors, however, owing to the confusion and rustle of the audience, the direct sound of a speaker's voice will rarely carry more than 50 or 60 feet in front of him, and, if Professor Henry is correct, should carry only 35 or 40 feet on either side of him, and only 15 or 18 feet behind him. This last figure certainly seems ultra-conservative.

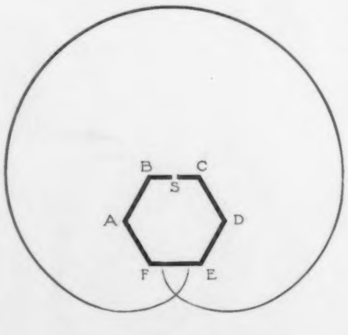


FIG. IX.

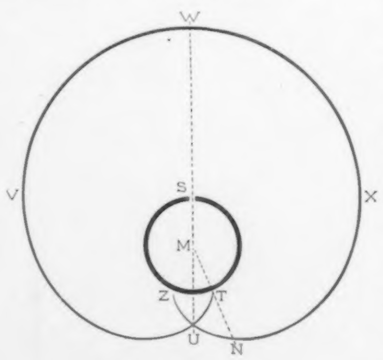


FIG. X.

These considerations have an obvious bearing upon the calculations for loudness in a

† As already mentioned, these results were published in *The Physical Review* for December, 1911.

large auditorium. If a speaker's voice is so faint behind him, its reflections from the surfaces behind him must be correspondingly faint. In the case of sounding boards, such as are often placed immediately back of a pulpit, the reduction in intensity requires special attention. For wall and ceiling surfaces a convenient assumption is that the intensity at the side of the speaker is three-quarters as great as in front, and behind him half as great. For ordinary purposes this seems to give sufficient accuracy.

Another point requiring attention is the fact that the reduction in intensity is very much greater for tones of high pitch than for those of low pitch. As every one knows, a sound of the human voice is made up of a number of pure tones, of which the lowest, or fundamental, gives the pitch, while the others determine the timbre in the case of music, and the character of the vowel sounds in the case of speech. An irregular reduction in the intensity of the higher or overtones must naturally interfere with both the quality of singing and the distinctness of speaking. With regard to the former, only a trained musician is qualified to decide. With regard to the latter, however, it may be stated that there is a noticeable tendency to indistinctness in the seats to right and left of a speaker. For this reason, as well as many others, it is desirable to plan a large auditorium as far as possible in the shape of a fan.

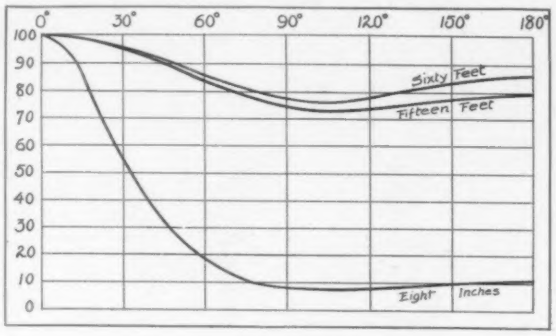


FIG. XI.

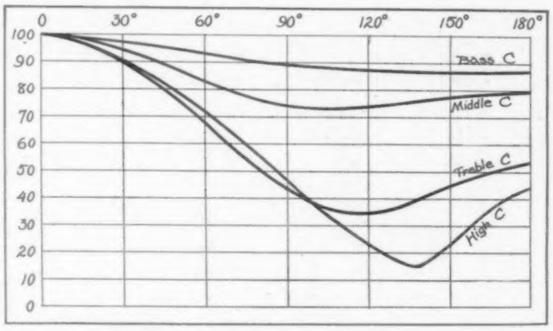


FIG. XII.

In this way the undesirable seats are eliminated, and moreover the speaker is not likely to turn so much toward one side to the detriment of the other.

Still another point is the interval of time which may be permitted to elapse between the arrival of the direct sound and the arrival of the first reflected sound. When the speaker faces the audience the effect of the direct sound is usually much louder than that of any reflected sound, and consequently has a tendency to continue for a brief moment, just as the effect of a bright light will continue for a very perceptible length of time after the light itself has been shut off. This after-sensation fills in the interval between the direct and the first reflected sound and causes them to appear as a continuous effect. But should the speaker happen to turn his back to the audience, conditions are reversed. The direct sound becomes the fainter, the after sensation is shortened, and the interval between the direct and the first reflected sound may become distinctly perceptible, with the result that the reflected sound is heard as an echo. Where this contingency is likely to arise, as in connection with religious services, the interval between the direct and the reflected sounds should be made much less than the sixteenth of a second which may be permitted under ordinary circumstances.

Gidea Park.

THE NEWEST ENGLISH GARDEN SUBURB.

BY R. RANDAL PHILLIPS.

THE garden suburb movement, after much preliminary discussion and many pioneer efforts, has taken a firm hold in England, and the Town Planning and Housing Act bids fair to extend it in a most astonishing fashion. Without going into the history of the movement in any detail, we may briefly recall its underlying principles. These, so far as the writer is able to perceive them, are embodied in the opinion that unrelieved streets of brick and stone houses in the midst of a town are the very antithesis of home life as it should and might be. Such streets were characteristic of English cities during the prosperous course of the nineteenth century, when agricultural employment was being increasingly supplanted by mechanical industry — a process which continues at the present day. Thus, more and more people became drawn into the city, and, housing accommodation being required for them, the speculating builder seized every available spot within the civic boundary and there erected as many houses as it is possible to set upon a given area. In this way has suburbandom been created — a place laid out in a haphazard manner, unrelated to its own parts and equally unrelated to the older civic area on the fringe of which it has sprung into being. Settling down on such an area, the custom of the speculating builder has been first to make a clean sweep of every tree and shrub which he found on the space, and thereafter to create a wilderness of bricks and mortar. The results thus achieved, however, soon began to give rise to a strong aversion on the part of the town dweller, and as time went on the latter sought relief by going outside the city boundary and there housing himself as comfortably as his means permitted. Whatever may be the tendency in other countries, the worker in England has an ingrained longing for a house amidst rural surroundings; hence, every evening thousands of city workers in London go out by tram, train, or omnibus to some suburban or rural area — as far away from the metropolis as the limits of their time and their income will allow — where they can escape from the rush and roar of a great city and can spend their leisure in following the pursuits or enjoying the delights of the semi-countryside. The same process has, of course, been going on for the past century. Time was when Islington and Chelsea were country places whither the townspeople liked to jaunt, but it is long years ago since these districts, and others far beyond them, were made part and parcel of an engulfing city, and as the area of London spreads farther and ever farther, so the workers extend their journeys outward to reach the country beyond.

PLAN OF GIDEA PARK SHOWING FUTURE EXTENSIONS.

It was under such conditions as these that the first garden city in England — Letchworth, in Hertfordshire, about thirty-five miles from London — was started about ten years ago, and the successful results there achieved were soon emulated in other districts. The idea of a garden city embraces more, however, than is contemplated in a garden suburb, for it means the creation of a

MEADWAY.

PARKWAY.

TYPICAL STREETS IN GIDEA PARK.

HOUSE IN PARKWAY, GIDEA PARK.
Reginald T. Longden, Architect.

place where work goes on side by side with residence; whereas the garden suburb is essentially a place of residence and recreation alone.

On the fringe of Hampstead Heath, on the high ground to the northwest of London, there has been built a most interesting suburb* where people of all classes are accommodated, and it was perhaps the success of this and similar undertakings that led to the development of Gidea Park, the latest of English garden suburbs.

In seeking country areas around the metropolis one is accustomed to go anywhere but to the east side, where great districts of squalid property, interspersed with factories and an unknown area of docks, constitute a formidable barrier to the seeker after country amenities. It is on this side, however, that Gidea Park has been discovered; for we may well call it a discovery, in view of the fact that, prior to its translation into a garden suburb, it was unknown, even by name, to the great majority of people in London, although it retained its natural beauties in much the same condition as when Queen Elizabeth visited the place nearly three centuries ago.

The area comprised in the estate is 450 acres. It abuts on the northern side of the great Roman road that runs from London through Essex to Colchester, and extends for a mile or more towards the wooded heights and parklands of Havering-atte-Bower. To the west is Raphael Park, an enclosure given to the public by Sir H. H. Raphael, M.P., — while to the east is the open undulating Essex country. At the south extremity of the estate a new station has been built at Squirrels Heath, whence a fast train takes one in less than half an hour to Liverpool Street.

As already indicated, the suburb is essentially residential, but as certain local requirements must inevitably be satisfied, a space has been laid out near the station where a shopping center is being formed and where, in due course, a market place will be developed.

Running right up through the estate is a beautiful piece of ground, about two hundred yards in width, which is preserved permanently as a golf course. The roads have been so laid out that there is a long frontage for houses looking onto this delightful space, and similarly, on the opposite side, the roads are so disposed as to give the utmost benefit to the houses that face Raphael Park.

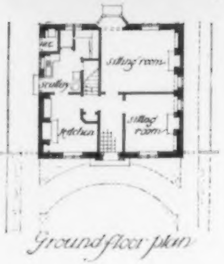
Additional attractions are afforded by the fish ponds and avenues of the old mansion of Gidea Park, which still remains a sturdy testimony to its Georgian builders, and by a large irregular green and pond around which winds Reed Pond Walk, with its bordering houses.

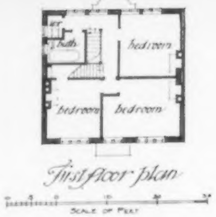
The estate was opened by the Right Hon. John Burns in July, 1910. It was eagerly taken up. Within a month of that date $60,000 worth of land in plots had been sold, and in the following spring more than one hundred architects and builders were busily engaged in erecting houses on them. In respect of these houses the estate is quite unique, for, with the object of securing the highest talent, the directors instituted a competition for the best houses.

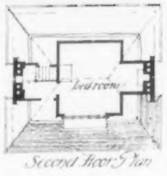
Substantial prizes were offered, and this had the result of attracting a number of capable architects to apply themselves to the problem of designing a small house on good lines. A strict limit of expenditure was imposed, the houses in Class I being required to cost not more than $2,500, and those in Class II not more than $1,775. Previously there had been a competition for the layout of the estate, the first premium of $500 having been awarded to the plan of Messrs. Gibson & Dann, and the second premium of $250 to the plan of Mr. Geoffry Lucas. In the house competition, the first place in Class I was given to the house in Parkway, by Mr. Geoffry Lucas (shown among the accompanying illustrations), and the first place in Class II to a house in Meadway, by Mr. C. M. Crickmer. Mr. Lucas's house, it will be seen, is very conveniently planned and, while having a room in the roof, does not follow the cottage type too closely. There is, moreover, a directness about its disposition, both in plan and elevation, which is very pleasing. The house is built of brick, lime whitened, with a red tiled roof. It is set back a short distance from the roadway (as may be seen in the general view of Parkway on page 229) and the kitchen has been kept to the front, in order that the garden at the rear may not be disturbed in the usual way. Standing like senti-

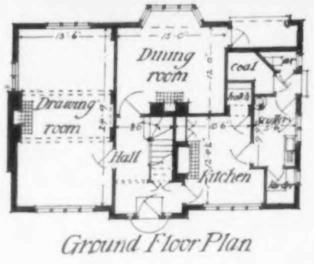
HOUSE ON HEATH DRIVE, GIDEA PARK.
W. Curtis Green, Architect.

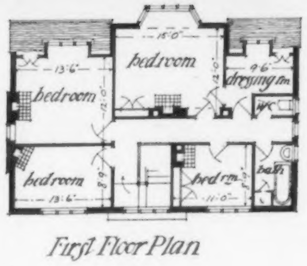
* See illustrated article in THE BRICKBUILDER, Jan., 1910.











THE FIRST PRIZE DESIGN HOUSE IN PARKWAY
GEOFFRY LUCAS, ARCHITECT

HOUSE ON HEATH DRIVE
MICHAEL BUNNEY AND CLIFFORD MAKINS, ARCHITECTS

TWO BRICK HOUSES IN GIDEA PARK

nels on either side of the garden plot are two little houses — one a tool shed, the other a garden house — which, with a modest architectural layout, add a note of formal symmetry that is most effective.

Another excellent house in Parkway is that by Mr. Reginald T. Longden. This is on a corner site, so that the entrance is contrived from one end. Both the sitting room and the dining room are of good size, and their bay windows are sufficiently large to be of real service, in contradistinction to those tiny projections which but disturb the elevation without adding any space that can be put to substantial use. This house is of red brick, with rough-cast gables and red tiled roof. The roof construction is very economical, and its shape is such that the upper rooms are not cut off at unfortunate angles.

On the opposite side of the estate, in Heath Drive, are many excellent little houses in brick. At the upper end are four in a row, by Ronald P. Jones. With these an attempt has been made to get away from the gabled type seen in English villages, and to take as model instead the plain fronts of the Georgian era. The result is not one that attracts the general public with any degree of enthusiasm, but to the writer it seems that these houses are a welcome relief to the ordinary type. They are sound square pieces of building without any attempt at pretentiousness, and their appearance will be admirable when, in the course of years, they have weathered down and a little kindly creeper has spread itself over the brickwork. Their window shutters are also of the right kind — that keep out the glare while admitting abundance of air; in which respect they differ from the solid heart-pierced type more favored by "country cottage" architects.

Close to this row of houses is a delightful corner house by Mr. Curtis Green. Here a feature has been made of the chimney stack, which is brought to the center of the roof and carried up as a sturdy piece of brickwork. Special care has been given to the garden, which has been made beautiful with a wealth of roses.

Still further along Heath Drive are several other pleasing houses in brick, among them the house by Messrs. Bunney and Makins shown among the accompanying illustrations. This, if one may say so, is between the cottage and the Georgian type, with strong leanings, however, towards the latter. There is very little outside woodwork about it, relief being obtained by herring-bone brickwork and bricks set on edge. It is not one of the competition houses, as may be judged from the plans, which include a drawing-room 24 feet 9 inches by 13 feet 6 inches, but it is a good example of the best class of work of its kind now being done.

With the numerous other houses at Gidea Park which rise far above the ordinary level (such as that by Mr. Clough Williams-Ellis seen on the left-hand side of the view in Reed Pond Walk), it is not possible now to deal, but sufficient has been said to show that this new English garden suburb reaches a high level of achievement. Though created only a few years ago, its rawness is already passing away, and after a few more years have elapsed it will have a most attractive appearance.

The suburb is being developed on sound financial lines, and the building work is thoroughly well executed. Houses are being built to suit all classes of occupants. Some are erected for rental purposes, others for purchasers' investment, others again by builders as speculation, while, occasionally, some are carried out by the estate company for clients; and in connection with the last the houses are either sold for cash or on extended payments over a period of from seven to thirty years. In all cases of extended terms the annual cost amounts to approximately the rental value of the house and includes life insurance of the purchaser. By this means a client taking an extended purchase knows that, should his life fail, the property immediately becomes the unencumbered property of his heirs — an arrangement which appeals to many.

It will thus be seen that not only has the general layout of the estate and the design of appropriate houses received full attention, but also that great consideration has been given to the means whereby people with limited incomes can secure for themselves houses in a garden suburb area not far from the metropolis, where they may enjoy the fresh air and the beauty of the countryside.

REED POND WALK, GIDEA PARK.

House on extreme left designed by Clough Williams-Ellis.
House at the end of the road designed by Reginald T. Longden.

A Moving Picture Theater.

THE ORPHEUS, CHICAGO, ILL.

ARONER & SOMERS, ARCHITECTS.

THIS moving picture theater is a noteworthy adaptation of terra cotta to surface treatment so often demanded by our modern architecture. During the last fifty years there has been no consistent construction, which would permit the development of a primary or fundamental style, such as has grown up in the past, modeled by some great national spirit and fired in the kilns of generations of time. Much of the interest has, therefore, been relegated to surfaces and façades, both in material and design. Of these the most frequent has been a façade between two walls with varied types of domestic and business buildings on either side, and the problem has been to give it the character of the building which it masks. The present example being a moving picture house, let us consider what is the architectural character of a moving picture theater and how this has been shown in the present design.

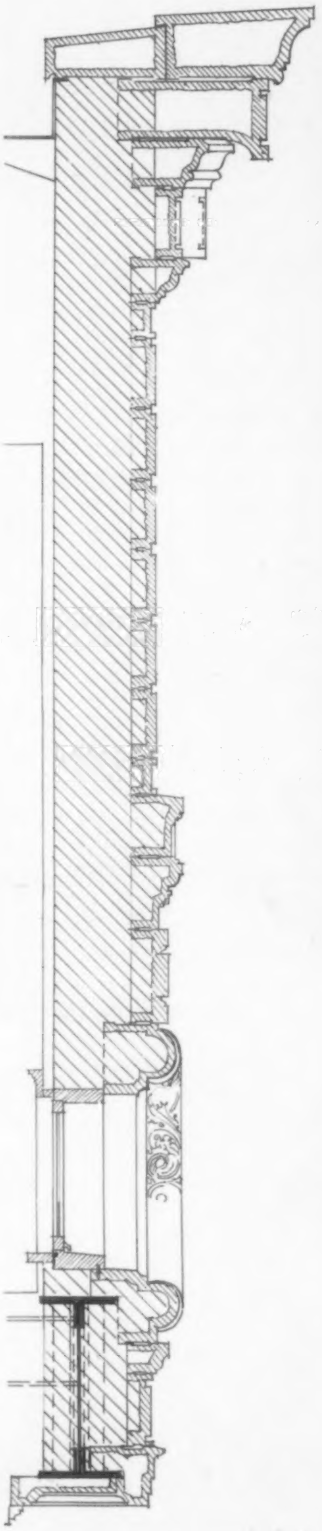
DETAIL OF ORNAMENT.

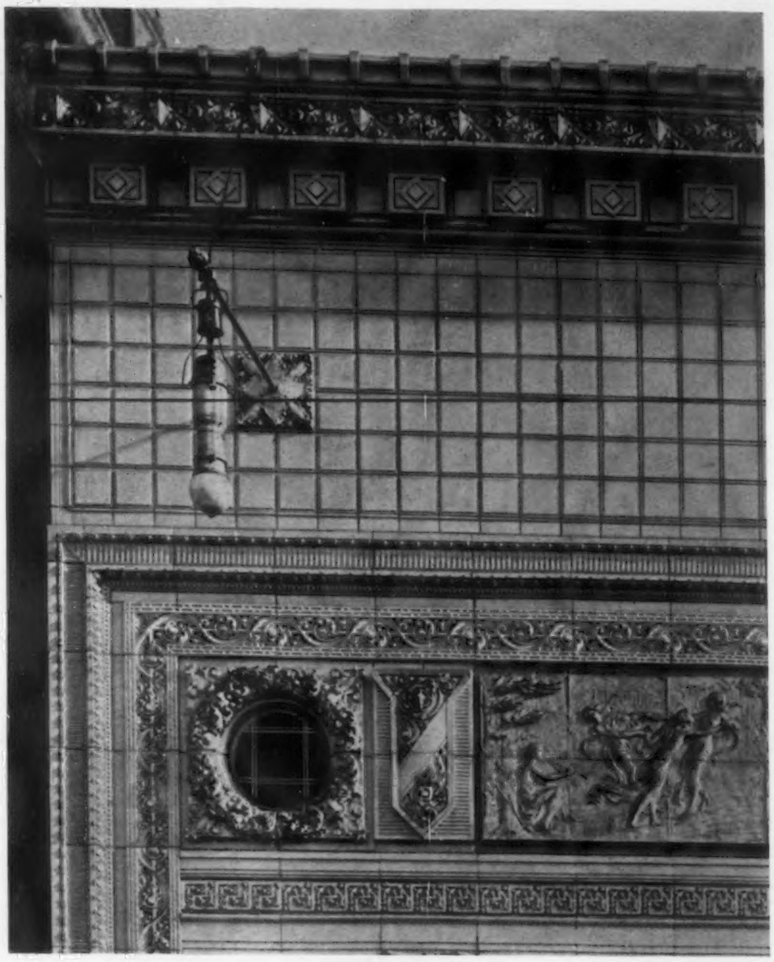
In general, moving picture theaters are dedicated to the lightest known kind of theatrical amusement — an amusement so modern and so newly invented that it was practically unheard of ten years ago. Its unabated popularity indicates that it supplies a much needed form of entertainment and that it has come to stay, or be supplanted by one still more popular. Even in this short time its design has had a history, which points to a steady advance along the gamut of theatrical expression, from the childish wonder façades of Coney Island to the impressive character of the Brooklyn Academy of Music — from meaningless frivolity towards sincerity, simplicity, and dignity. In this little theater a frank attempt has been made to reach a high form of architectural expression, with as much dignity and architectural quality in its composition as would be consistent with the spirit of the building, depending for its gaiety upon the details and general color scheme.

The composition of the façade has been cleverly and well managed. It has been designed as a decorative entrance, and all motifs which would tend to destroy that impression have been omitted. The entrance proper consists of a number of glass paneled doors, held in a casing of glass and steel, which covers the entire opening. This is protected from inclement weather by a light metal marquise. On the surface of the building, the opening is framed in at the sides by a monumental border of running ornaments, and at the top by a bas-relief which is accentuated at both ends by decorative openings which ventilate the toilets. The border which continues around and above the bas-relief is surmounted by a surface patterned with terra cotta tile, and above this surface is the slightly projecting cornice and coping. All architectural embellishments have been subordinated to secure a monumental effect with a simple mass unbroken by decided motifs or shadows. This treatment looks especially well at night when the blaze of light from the lamps is reflected by all portions of its glazed surface. The gaiety is indicated by the life of the ornament; the playful note of the sculptures in the bas-relief which are symbolical of the ancient, medieval, and modern dance; by the cabinet-like glass casing of the entrance opening; and most of all by the high color tone and texture of the terra cotta surface.

The fact that a large mass of masonry, held by two supports and reinforced by two columns near the two ends of the façade, is suspended over the entrance is not disturbing. Had stone or brick been used in any form, the actual length of the span would have been noticeable. In this case, with the glass casing, and the terra cotta incrustation above and around it, a light form of veneer has been obtained which leads the mind to accept the presence and sufficiency of the unseen steel supports.

Terra cotta has been ideally used in this façade, where it distinctly gives the impression of terre-cuite or faience. In the patterned tile above the frame the joints are lost to view by a slight rustication, and the constructive appearance of brick or stone is avoided by continuous vertical joints. The columns at each side of the entrance have been made octagonal, with lines of ornament at the corners





DETAIL OF ENTABLATURE

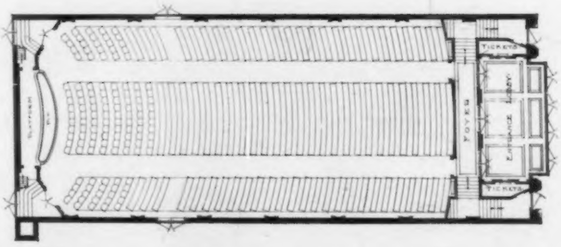
SECTION THROUGH ENTABLATURE

DETAIL OF SMALL WINDOW ARCHITRAVE

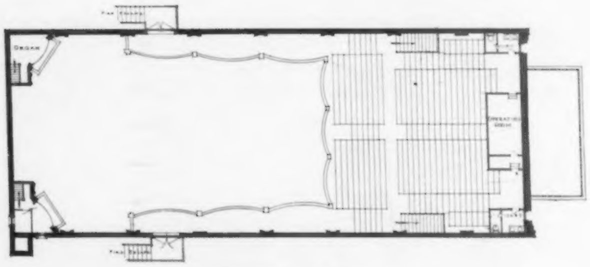
DETAIL OF CAPITAL ON PIERS

THE ORPHEUS THEATER, CHICAGO, ILL.

ARONER & SOMERS, ARCHITECTS



AUDITORIUM FLOOR PLAN



BALCONY FLOOR PLAN

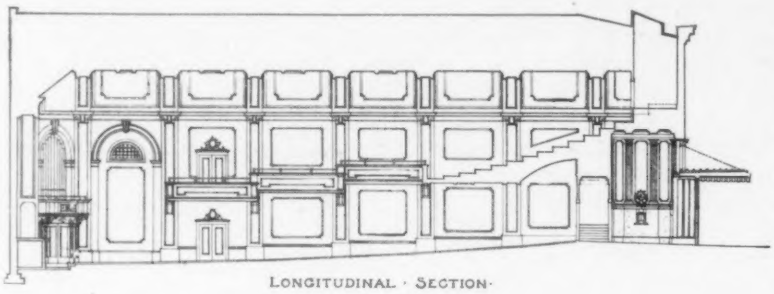
THE increasing popularity of the moving-picture theater would indicate that it supplies a needed form of entertainment and that it has come to stay. In plan it differs from the general theater, in that no stage or scenery is necessary, but in their stead a small platform, usually less than ten feet in width, is arranged in front of the screen on which the pictures are shown. Only one balcony is customary, and much less space is devoted to foyer and retiring rooms. This is a typical example of the plan as it has been developed. It fulfils all the requirements of this type of structure, both from the business management viewpoint and the legal, with the exception of the rear exits which are placed too far from the rear of the theater to facilitate a rapid exit in the case of an emergency, and the absence of an outside fireproof passageway leading to the principal street.

THE ORPHEUS THEATER, CHICAGO, ILL.

ARONER & SOMERS, ARCHITECTS

to indicate surface veneer. Precise lines and deep undercutting in the decorations — a distinctive quality of cut stonework — have not been striven for. The restrained projection of the cornice shows an attempt to avoid heavy angle iron supports, and all sculptural decoration has been wisely kept in low relief, similar to the relief on pottery.

It is unfortunate that economy forbade the use of polychrome terra cotta, except in the light warm gray of the bas-relief. What an opportunity to give warmth to the surface, similar to that of the Doge's Palace, and color to the ornament! There is a distinctive need for bright colors in southern climates where sunlight is strong and all color contrasts great; there is also a need for less intensity of color as the latitude becomes more northern, the sunlight less strong, and contrasts weaker. How successfully have McKim, Mead & White handled the terra-cotta colors in the Madison Avenue Presbyterian Church in New York City, keeping all surface colors low in tone, so as to interest the surface but not to interfere with the general color of the mass. Intense colors have been reserved for the background of projecting ornaments, as, for example, in the deep blue of the bell form, back of the acanthus leaves of the Corinthian capitals.



LONGITUDINAL · SECTION·

ORPHEUS THEATER, CHICAGO, ILL.
Aroner & Somers, Architects.

The economic feature of terra cotta in decorative work, for which the same model may be used repeatedly, is a strong reason for its use in the façades of moving picture theaters. Plaster and stucco are not durable, and stone is too expensive, whereas terra cotta can so easily be modeled, that it lends itself to theatrical expression at small cost and decorative effect. Another valuable asset in terra cotta work is the ease with which it can be cleaned. This is especially important in Chicago, where the atmosphere is so charged with dirt which settles on the exteriors of buildings that a new structure becomes dingy in a very short time. A glazed terra cotta surface, however, looks just as fresh and bright after cleaning as when new.

Just what will develop in the future architecture of the moving picture theater is an interesting question for conjecture. No doubt the type presented here will have an influence on later designs, and, like all pioneer work, may be improved upon. Its Chicago-esque decoration has not been commented upon, as this is a matter for each architect to form his own opinion.

EDITORIAL COMMENT AND NOTES FOR THE MONTH

THE interest in town planning which is being made more manifest in this country each successive year, and which is brought to our particular attention by letters from interested readers in all parts of the country, makes the presentation in this issue of Gidea Park, the newest English garden suburb, of particular timeliness.

In the past year many American cities, notably Philadelphia, Boston, Newark, and Jersey City, have appointed investigating committees to study the conditions under which the poorer inhabitants are housed, and while the reports which these committees have prepared in all cases state the existing conditions at great length and with helpful criticism, there is little contained in them to suggest emphatic remedial measures or improved methods for bringing about more satisfactory conditions. It is in this respect that a study of this English suburb can be most helpful, for it provides a visible proof of the practical application of principles which are universally recognized as sound and applicable to conditions in a country having democratic ideals. Many of the reform movements such as municipal housing, co-operative ownership, etc., which have proved successful in Europe cannot be applied in America with equally effective results because of the varied nationalities and circumstances of the working people of this country. It, however, remains one of the serious problems which confront our growing cities and towns, and one in which thoughtful study and research will have a noticeable effect on the physical and moral life of our large communities.

The growth of most of our American cities is the result of real estate enterprise, which has for its motive the sale of building lots without any thought of the future of the community which its activities are establishing. The operations of the average speculative builder and real estate promoter have filled whole areas of our cities with ugly and inflammable houses which only recently, from their great number and the impending fire peril, have come to the notice of those civic officials who are sufficiently public-spirited to place the welfare of the community as a whole above the financial interests of large and politically powerful property holders, and to promote legislation which will correct this evil.

In the suburban areas the remedy for this situation is collective planning, which will permit houses to be grouped in an architectural fashion and which will remove the ugly proportions now imposed on them by the hard and fast current system of lot sizes. If real estate builders and even groups of friendly individuals who are building in the suburbs can be made to realize the more pleasing effects, as well as greater economy in building operations, to be derived from giving one architect the commission to design a group of houses, it will undoubtedly be effective in interesting more of our most able architects in this really important social problem.

IT is not so difficult, according to Mr. Collins, writing upon "Symbolism in Architecture," to determine the symbolic meaning of an animal carved by a medieval church builder as "to find out for certain what animals the carvings before us represent." This plaint casts a less denigrating reflection on the realism of the old wood and stone cutters than would at first appear. They not only had the conventionalizing genius that made it easy for them to twist ape and lion, fox and boar, into shapes suitable to the places designed for ornament, but they had the old unexacting credulity that believed in things by their names, and when no model for a dragon or a centaur was forthcoming, they created an animal in the image of their imagination. Thus on the hoary doors and arches of Winchester and Ely, of Hereford, Canterbury, Southfleet, and Ampney, are found such strange companions as hyena, camel, whale, griffin, sagittarius, dove, and unicorn, each with a message to the superstitious mind and a bit of folklore for the historian. "The early naturalists, whether Greek, Roman, or Alexandrian, were not scientific," says the author.

Much of the symbolism refers to attributes of the animals depicted which are unfamiliar to the readers of to-day. We all, for example, know the type of the salamander on the side of its fire-resisting properties and the parallel of the virtuous person who passes through the fires of temptation and is not consumed; but we hear less often of that hateful salamander habit of infecting pleasant fruits with poison so that all who eat them die. The second attribute completes the pretty picture of selfish malice, providing a type that saves itself and destroys others.

Mr. Collins considers his little book as an aid to the popularization of a pleasant study, and in his concluding chapter suggests that his readers equip themselves with the proper kind of camera, one equipped with good lenses of different focal lengths, and pursue the subject further. It is an idea to tempt the summer wanderer in the cathedral towns.

WHAT can be gained from a scientific treatment of art? It has been claimed that we have arrived at a time when some science or reasoning should be infused into architecture and into everything that we call "art." Quotations from several writers on architecture tend to show that there has been little written which is of much help in answering the question.

The history of architecture is the history of the world. — *A. W. Pugin.*

The influence of the causes which act most powerfully on the genius of the arts, after the climate, are the manners, religion, and the changes to which a nation is subject in its political state during the course of ages. — *Seroux D'Agincourt.*

Unless art is the expression of the system it should illustrate, it

loses at once its greatest claim on admiration and fails to awaken any feelings of sympathy in the heart of the spectator. — *A. W. Pugin.*

Architecture is the art which so disposes and adorns the edifices raised by man, for whatsoever uses, that the sight of them contributes to his mental health, power, and pleasure.

Architecture concerns itself only with those characters of an edifice which are above and beyond its common uses. — *John Ruskin.*

Architecture depends on fitness, arrangement, and on proportion, uniformity, consistency, and economy. The perfection of all works depends on their fitness to answer the need proposed, and on principles resulting from a consideration of Nature herself; and the ancients approved only those which by strict analogy were borne out by the appearance of utility. — *Vitruvius.*

By means of design we inscribe, or ought to inscribe, upon every object of which we determine the form, all essential particulars concerning its material, its method of construction, and its uses. — *M. D. Wyatt.*

PLATE DESCRIPTION.

PLATES 145, 146. The problem of designing a building suitable for the activities of the Young Women's Christian Association is comparatively new in the field of architecture, and consequently calls for special study on the part of the designer, without the aid of many examples to draw upon for precedent or inspiration. The growth of the organization has been so rapid and the various activities which it embraces have become so numerous that many of the buildings now occupied are not adapted to its needs.

The main object of the association is to provide in its buildings facilities for religious training, athletic exercises, education along practical or technical lines and social diversion. These various uses to which the building is subjected suggest a design of the character of a club, with its possibilities for comfortable life. The adapted Italian Renaissance style in which the building is designed creates this impression and lends a certain dignity to the façade, at the same time not sacrificing any appearance of domesticity which such a building should express.

The large amount of space required for athletic purposes, comprising gymnasium, swimming pool, and individual dressing rooms, makes an economical division of the floor area necessary. It is interesting to note on the basement plan the manner in which a great deal of space has been saved by the grouping of four dressing rooms about a single shower bath.

The building is thoroughly fireproof, the structural parts being of reinforced concrete and the facing material of rough mat bricks in an ash-gray color, with the architraves, belt courses, etc., in architectural terra cotta of the same shade. The floors throughout the interior are either of tile, marble mosaic, or composition. The flat roof of the main building is floored with promenade tile to provide recreation space in warm weather.

The cost of the building, including all equipment, was $246,683, or about 26 cents per cubic foot.

PLATES 147, 148. This is a sturdy design in red brick and stone after the style of early Colonial buildings. It is a type of building common to all New England towns, and exceptionally capable of meeting the many different demands made upon it.

The building contains the town offices, a town hall, a banquet hall with kitchen, serving rooms, coat rooms, smoking room, etc., in connection with it; also a large room for the use of the local Grand Army Post. The main hall has a seating capacity of one thousand, with an additional hundred in the gallery, and is equipped with a stage and the necessary dressing rooms.

The exterior walls are constructed of red water-struck brick, with cast stone trimmings laid up with wide raked joints, the mortar below the water table colored red and that for the remainder of the walls white. The roof is of black slate and surmounted by a copper-covered cupola.

The cost of the building, including all equipment and furniture, was about $82,000.

PLATES 152, 153. The Latrobe apartment house is situated in close proximity to a number of the fine old homes in Baltimore, and with its reserved and pleasing façades designed in an adaptation of the Florentine Renaissance it fits in well with its surroundings. It is a distinct relief to observe an apartment where fanciful ornament has been disposed on the façade with a restrained hand. The detail shows evidence of careful study in regard to scale and form, with the single exception of the entrance features, which seem to be dwarfed by the bold treatment of the first and second story windows. The exterior walls are of gray wire-cut brick, very soft and pleasing in tone, with the architraves, cornice, and decorative features in a contrasting light shade of terra cotta.

PLATES 154, 155, 156. This residence is a particularly good example of the desirability of designing both house and surroundings together, so that they may appear related to each other, and that the gardens and other open-air features are in intimate connection with the living rooms.

The first floor plan is admirably thought out and makes a very interesting arrangement of rooms; the three main rooms being spacious, well proportioned, and well located, in connection with each other and with the outdoor rooms on the terrace. The servants' quarters and the kitchen are entirely confined to a separate wing — the separation between which and the living portion of the house is as complete as it is possible to conceive.

The interiors designed by Mr. Shaw are characterized by a breadth of treatment and a vigorous style that, while not following any specific period of decoration or proclaiming itself as an entirely original idea of the architect, gives them an air of decided individuality, but withal real architectural appropriateness.

The two interiors selected to illustrate this house prove this point clearly and in addition show evidence of particularly pleasing plaster work which Mr. Shaw often uses with much effect in an informal way. The pattern used on the vaulted ceiling of the hall is perhaps unfortunate in the way it works out at the ribs of the vault, but the general effect is of fine decorative value.

PLATE 157. This is undoubtedly as simple an expression of residence architecture as can be had. The design can hardly be said to be derived from any established precedent, but it is a simple, straightforward expression of the plan, carried out without any special attempt at symmetry, yet having a balance that makes it a restful composition. The materials used on the exterior walls are dark red brick with cast stone trimmings. All architectural detail has been confined to the main entrance, which has an unusual charm, obtained by good use of simple materials. The living porch at the end, however, seems somewhat foreign to the house, caused possibly by the awkward relation between cornice and supports.